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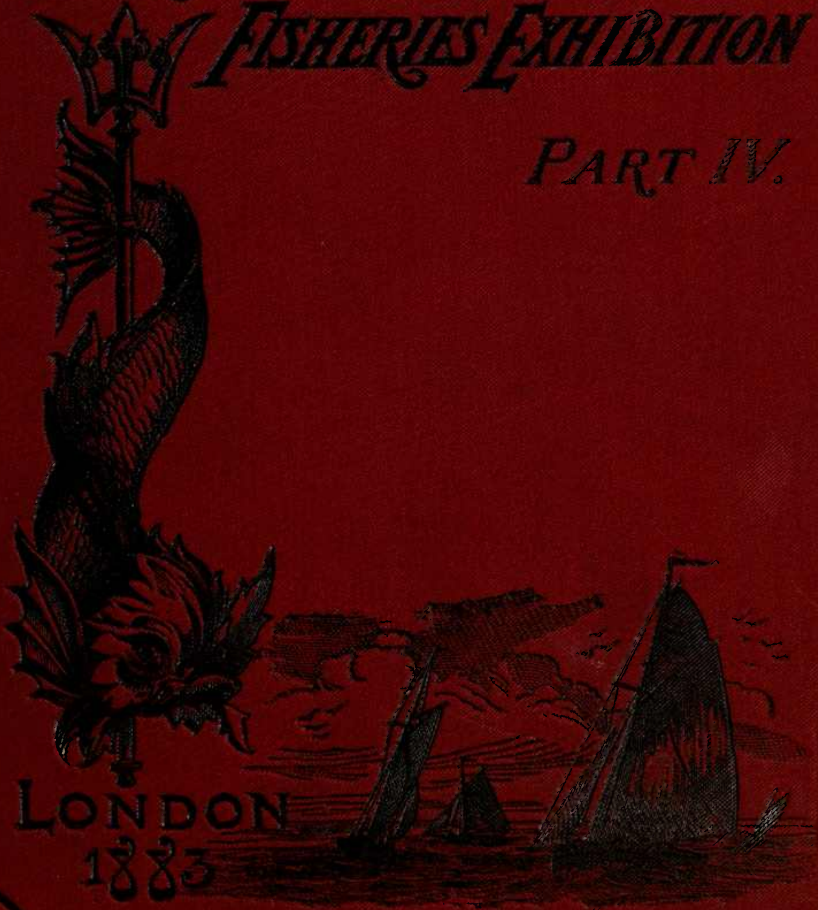
PART IV.



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International Fisheries Exhibition
LONDON, 1883

THE
FISHERIES EXHIBITION LITERATURE.

VOLUME VII.

CONFERENCES—PART IV.

FISH AS FOOD.
THE PRESERVATION OF FISH LIFE IN RIVERS BY THE EXCLUSION OF TOWN SEWAGE.
THE FISHERIES OF IRELAND.
IMPROVED FACILITIES FOR THE CAPTURE, ECONOMIC TRANSMISSION AND DISTRIBUTION OF SEA FISHES, ETC.
SEAL FISHERIES. STORM WARNINGS.
SAVING LIFE AT SEA.
FISH PRESERVATION AND REFRIGERATION.
THE BASIS FOR LEGISLATION ON FISHERY QUESTIONS.
FOREST PROTECTION AND TREE CULTURE ON WATER FRONTAGES.
LINE FISHING. TRAWLING.

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CONFERENCES—PART IV.

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FISH AS FOOD.

BY

SIR HENRY THOMPSON, M.B. (LOND.), F.R.C.S., &c.

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CONFERENCE ON TUESDAY, JULY 17, 1883.

SIR PHILIP CUNLIFFE-OWEN, K.C.M.G., C.B., C.I.E., in the Chair.

The CHAIRMAN, in introducing Sir Henry Thompson, said he felt it a special privilege to take the chair on that occasion. They all knew Sir Henry Thompson as one of the most eminent surgeons in the world, but it was perhaps not quite so well known that he took very great interest in all subjects that were for the benefit and welfare of the human race. He was not sure whether the information they were about to receive, would not enable them to dispense to a certain extent with the services of the physician, but he was quite certain that the important questions relating to the use of fish as food would be dealt with in such a manner as could not fail to be of the utmost benefit to them all.

FISH AS FOOD.

I confess that it is with a deep sense of its importance, that I enter upon the discussion of the subject which is to occupy us to-day. The brief terms which designate it, present to our consideration questions of the highest interest to the entire population of this country, every inhabitant of which now lives within easy distance of a seashore; an interest indeed, which thus equally affects a large proportion of the human race in various parts of the world.

Fish as Food! Is not the fact thus tersely denoted, the essential and practical expression of the entire organisation which this great Exhibition presents? True, there are other modes of utilising fish besides that universal one of eating it; of which manifold illustrations may be seen here. But these exceptional uses are comparatively so insignificant, that the fact that fish is food for man must be accepted as the chief motive for bringing together this comprehensive collection of all matters pertaining to the natural history, the culture, and the various systems of capturing and preserving fish, contributed from every quarter of the globe.

It is our business here to-day to ascertain, so far as available data enable us to do so, what are the nutritive qualities which fish possesses, rendering it serviceable to the consumer; and how far these qualities can be best utilised by art. Further, inasmuch as the appropriateness of food for every individual is determined chiefly by its corresponding with the demand which his habits of life and occupation entail, and which vary so greatly in every population, an attempt will be made to indicate in general terms, under what circumstances fish appears to be most desirable to select as a chief article of diet.

I shall first endeavour to appreciate the value of fish generally as a source to the human body, of nutritive material, by comparing it with that which is supplied by other well-known forms of food. Then the leading characteristics of some different kinds of fish more or less available for the inhabitants of Great Britain will be considered.

And, lastly, some hints will be presented in relation to the economic uses and to the cooking of fish, and to the art of combining other materials with it, in order to supplement its natural deficiency in certain constituents necessary to render it a complete and acceptable food.

Most persons who have not acquired the rudiments of that most useful and interesting branch of learning, which treats of the structure and functions of the human body, are surprised to learn that from two-thirds to three-quarters of it, judging by weight, consist of water ; and this proportion is the same, or nearly so, in all the land animals which are consumed by man for his own support.

Thus in every hundred pounds weight of healthy flesh, not artificially fattened, whether beef, mutton, or poultry, and from which the bone has been removed, about seventy-five to seventy-eight pounds of water are present, and are separated as such from the solid matter of the meat in the processes of cooking and digestion. Twenty-five pounds or a little less, that is to say, not quite a fourth of the whole, alone are solid, and alone contain nutritive material. Speaking roughly, these twenty-five pounds are constituted as follows :—

About sixteen or seventeen pounds consist of the essential elements of the flesh or muscle, and of the solid part of the blood, which afford the important nitrogenous constituents of food ; the "albuminoid," or "flesh-formers," but not including another nitrogenous compound known as "gelatine," which is a type of the next group.

Of this gelatine, with some allied compounds, about one to two pounds are present ; but although nitrogenous compounds, they are distinct from the preceding class of flesh formers, and possess much less nutritive value as food.

Of fatty matters, about two to four pounds may be reckoned.

The remainder consists of what are known as "extractives," and of various saline and even metallic matters, all of which are essential parts of the animal body.

It is necessary to observe that when meat is unduly fattened, as very often happens, the above proportions are greatly altered. When the meat is fat pork, for example, reared for bacon making, &c., or beef which is fed in order to secure a prize for size and weight, the products are wholly different, containing largely fat, with less albumen and fibrin, and but little water; and the pig owes his existence in great measure to the facility with which he produces fat meat for human food, such fat being of special value to use in combination with other foods which contain almost none of it.

Now let us compare with these animal foods one or two chief products of the vegetable kingdom; and as a typical example, because familiar to us all, and extensively used, fresh wheaten bread. In one hundred parts of this forty are water, fifty are starch, about eight consist of the nitrogenous principle corresponding to the albuminoid or flesh-forming elements in flesh, and there is but a fraction of fatty matter, the remainder being salts, &c. Fat, as you see, is almost absent in wheat; there is rather more of it in oats; still more in Indian corn. There is almost none in the potato, about three parts out of four of which are water: the solids consisting mainly of starch, associated with only about two per cent. of the flesh-forming principle. On the other hand, leguminous seeds, as peas, beans, and lentils, contain the flesh-forming principle in even larger proportion than that which is present in wheat, and also in animal food generally, but with very little fat.

With these broad general statements, put into the simplest form so that we may keep them in view without effort for a short time, let us now see what is the composition of fish. There is a closer resemblance, at first sight, perhaps, than many persons would expect to find. Notwithstanding that the fish is an inhabitant of water, and cannot live out of it, the proportion of that element in the animal's structure exceeds only by a small amount the proportion which is present in land animals. In other words, the solid constituents of fish as a class, and there are important exceptions here and there, are but little less in weight, than those which the flesh of cattle contains, and which are already before you.

In one hundred pounds of fish without bone, from seventy-five to eighty-five are water, or rather more than three-quarters of the whole; leaving, say, about twenty pounds of solids as a mean estimate. Of these, about twelve to eighteen pounds are nitrogenous compounds. The most important, or flesh-forming principle, is less in quantity than in meat, and there is a rather larger proportion of gelatine; they are placed in one group here, for further analyses of fish are required before accurate quantitative results are forthcoming in relation to this question.

The fat in fish varies in quantity greatly, somewhat according to the condition of the fish and season, but mainly with the different species. It is less than one pound in the hundred in sole, whiting, and haddock; much the same in turbot, brill, cod (without liver), and dory. It is a little more in the plaice, and rises to seven pounds in the hundred in the herring, to twelve or more in the salmon, fifteen or sixteen in the mackerel, and even to thirty in the eel.* In all these it is dispersed throughout the body. But some fish have it largely stored in the liver, as in the cod, skate, red mullet, &c. And of course where much fat is present, the amount of water is diminished in a corresponding ratio.

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* I am indebted for these amounts to the recent researches of Dr. J. Kœnig, kindly forwarded to me by Professor Church, author of the excellent South Kensington handbook on "Food."

The various saline, and other matters remaining, vary between one and two pounds in the hundred.

Analysis in General Terms of the Composition of the Flesh of a Healthy Animal, not artificially fattened, and omitting the Bones.

In 100 parts.

About	75 to 78	are water.	
Leaving	22 „ 25	of solids.	

Of these solids—

About	16 or 17	are albuminoids or flesh-forming material	Nitrogenous compounds.
„	1 to 2	„ gelatine	
„	2 „ 4	„ fat.	

Remainder—“Extractives” and salts.

Analysis of Wheaten Bread.

In 100 parts.

About	40	are water.
„	50	„ starch.
„	8	„ albuminoids.

Remainder—A trace of fat with salts.

Analysis of White Fish without Bone (Sole, Whiting, Turbot, &c.).

In 100 parts.

About	75 to 85	are water.
„	20	„ solids.

Of these solids—

About	12 to 18	are partly albuminoids, with a rather large proportion of gelatine	Nitrogenous compounds.

Remainder—A little fat with salts.

In some fish where the fat is large in quantity (herring, mackerel, salmon, &c.), the water is correspondingly diminished.

Comparing the foregoing tables with each other, we may arrive at an approximate estimate of the place which fish occupies as nutrient material among the other products which the animal kingdom offers to man. Let me first say that our estimate has thus far been based solely on the facts afforded by a chemical analysis (without reference to other considerations of minor importance)* of three typical kinds of food, viz., meat, wheaten bread, and fish. Possessing this, the fitness for man's use of any food is estimated by the presence of those elements which his body requires for its renovation, to sustain its temperature, and to supply force for labour; and presented in a form which the body can readily assimilate. But we must bear in mind a subject already just alluded to, that the several elements of food which have been named are required by different individuals in very different proportions, which vary according to the daily occupations which such individuals pursue.

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* I think it must be admitted that while as a general rule, the nutritive value of food is to be determined by the presence in it of certain chemical elements, harmoniously adjusted to the composition of the body to be nourished, yet there are some restorative qualities contained in animal flesh, which, although not at present fully appreciated by chemical analysis, have a value of no mean order, demonstrative chiefly by empirical observation. The invigorating effect of a small quantity of beef-tea, in a person suffering from inanition, may be cited in illustration ; the solid matter resulting from its evaporation being insignificant in quantity when compared with the support afforded. Now the product obtained by dealing with fish, in the same manner as we treat beef in order to obtain "beef-tea," is greatly inferior in this restorative quality, although the solids present are larger in quantity in "fish-tea" than in that of meat.

I have had the following experiments performed in the most accurate manner, which will show in part the nature of the chemical difference.

One pound of rumpsteak, one pound of turbot, each without skin and bone, the former freed from fat, were thus separately treated. The flesh was passed twice through a sausage-machine, and sufficient cold water to cover (one pint) was added. After standing one hour, the mass was heated to boiling point, and allowed to simmer ten minutes, then strained through calico, and the contents of the strainer washed with water : a little floating fat was removed (in the case of the beef.) Each of the liquids was evaporated on a water bath to the consistence of a soft extract.

Beef-product.

Weight of extract, 276 grains or 3·94 per cent.
In this product 5 per cent. of gelatine was present.

Fish-product.

Weight of extract, 396 grains or 5·6 per cent.
In this product the gelatine amounted to 21·8 per cent.

It has fallen to my lot, in the exercise of daily duty for many years past, to observe and to study the views and habits of my countrymen in relation to their diet, and it is impossible not to remark the want of intelligent thought bestowed by people generally on the subject of food, although it is one of which it is scarcely possible to overrate the importance. Thus that large and actively engaged portion of society, designated usually by the term "middle-class," appear for the most part to adopt an almost uniform dietary, the constituents of which, and the method of serving them, vary little from a certain regulation pattern; and each person accepts and conforms to it for the most part without thought or enquiry as to its fitness for him. The pattern adopted by the working man, more restricted in kind, is followed in the same unvarying fashion. And in very few instances, even among the best educated persons, can it be said that the individual exercises much discrimination in respect of those external influences affecting the body and conditions of it, which demand selection of food and variety in its character to meet the circumstances of his own particular case.

I shall name three important factors, always to be regarded in connection with the selection of our food, the bearing of which on the subject of a fish dietary will appear.

The first is the effect of hard labour involving considerable muscular exertion.

The second is the influence of climate or of temperature on the body.

The third is the influence of age.

In relation to the effect of continued muscular exertion, it must be manifest that the porter, the navvy, the labouring mechanic, the agricultural labourer, and the marching soldier, require food in quantity and kind, differing widely from that which the sedentary man of letters and the counting-house clerk demand; marked and contrasted types which we may refer to hereafter, and between which innumerable modifications of condition exist.

For the purpose of sustaining severe and continued muscular exercise, the diet must contain a good proportion of fatty matters, and of starchy matters; also a moderate amount of albuminoid or flesh-forming elements, together with earthy and other salts of course. All but one of these are present in the flesh of animals, the missing element, starch, being supplied by adding bread, potatoes, rice, &c., a practice which has been empirically followed for ages, long before the physiological reason was known. Many cereal grains, wheat, oats, &c., and also peas and beans, contain both flesh-forming material and starch; hence bread has been termed, not quite correctly, but nearly so, the "staff of life." All these are deficient in fatty matters, which are necessary to the working-man, who adds butter, bacon, suet, lard, or oil (in other countries), in order to supply his expenditure. No hard labour can be achieved without the consumption of a considerable amount of fatty substance. For our labourers then, all ordinary fish (some notable exceptions having been named) is deficient in fat, and does not contain a large proportion of the flesh-forming albuminoid. He cannot live on fish alone, but he may add starch in the form of potato or rice, better still bread, and fat, as bacon or lard. I can scarcely give you a more apposite and interesting illustration of this than the following:—On the southern coasts of England, notably in Cornwall and Devonshire, the fishing population, who work very hard, and require therefore an appropriate diet, deal with their fish in the following manner, and it forms the staple of their nourishment for a large part of the year. Portions of any fresh fish are cut up and placed in a large pie dish, among them some thick morsels of fat pork, with salt and pepper; the whole is covered with a substantial crust, and baked. Mark how all the elements necessary to the man who toils hard are combined, and in perfect proportions to his needs. A moderate amount of nitrogenous matter appears in the fish, and also in the flour of the crust, which latter also contains the necessary starch; the fatty matters deficient in fish are furnished by the bacon, and also by the lard with which the crust is made, while the necessary salts appear in each of the constituents named.

It has been said by some persons, as I am informed, that the fish dinners supplied at the Exhibition, although plentiful in quantity, do not afford support for any length of time, and that the desire for food soon returns. Of course that must be so in the case of those who lead an active life from morning to night; a fish dinner may be desirable now and then for persons so employed, but something more than fish is requisite to sustain the laborious exercises demanded of them. Suppose that a plate of fish and some bread have been eaten, a small plate to follow, say, of bacon and beans, of suet pudding or sausage roll, or of a fruit tart with substantial crust, will at once supply the elements which an ordinary dish of fish fails to offer; while a pleasant sense of satisfaction will follow, and no complaint of void will be heard until the accustomed period of time has elapsed.

On the other hand, for those whose physical labour is light, other products of a less substantial kind may furnish the indispensable adjunct; and thus we become acquainted with the fact that the very sauces which long usage has decreed shall accompany fish at our tables, consist precisely of those materials which science has proved to be essential in order to render the dish not merely acceptable to the palate, but a perfect and harmonious combination of the very elements which man requires for all the purposes of life. The Hollandaise sauce, the Mayonnaise, the melted butter, with their innumerable variations, all composed more or less of olive oil, yolk of egg and butter, afford the exact complementary material in which the fish is naturally deficient.

I cannot help adverting to the curious fact, which I have no doubt arises from the physiological law I have been illustrating, that at a Greenwich fish dinner from time immemorial, however profuse and varied the service of fish has been, at the end of it appears a fat ham or a handsome piece of Hampshire bacon, surrounded by broad beans. Clearly the dish is not really wanted in such luxurious circumstances, but it is beyond doubt a survival of the practice founded on a natural want, and discovered empirically; and the bacon makes its appearance because experience had ages ago taught mankind that after fish or with fish a portion of fat is demanded.

There is no doubt that the obvious and admitted value of a highly nitrogenous food, of which meat is a concentrated form, to the labouring man, has occasioned the almost universal belief that such meat, of which let beef and mutton be the type, is the most desirable food staple for all. "If you wish to be strong, eat plenty of meat;" "If you are feeling weak, eat more meat, and at every meal;" such are the well-known articles of a creed which is deeply graven in the popular mind. Nevertheless few statements relating to diet can be more misleading, and few are, in my opinion, productive of more evil to the community.

It is this habit of adopting meat as the chief element of his dietary, which the sedentary man, with little opportunity for bodily exercise, the man who uses his brain more than his muscles, should especially avoid. Equally also should he abstain from fatty matters in large quantity, taking only a moderate proportion, which is not only permissible, but necessary to that extent. For if he habitually consumes these two classes of food freely, materials are introduced into the system which it cannot eliminate, and which must ultimately obstruct the function of some internal organ. Thus the periodical bilious attack, or the recurring fit of gout, or some other relentless tormentor, clears the system for a time of the offending matter which the daily error in diet is perpetually reproducing and accumulating. Those who are thus affected often endeavour to ward off their troubles by systematic muscular exercises, fencing, rowing, and the like, and they do so with a certain amount of success. It is for the purpose of getting rid of superfluous nutritive materials that others (who may be wholly unconscious of the need which impels them) secure their yearly shootings, make Alpine excursions, or seek the mineral springs of a foreign spa, contrivances, all of them, for effecting the required elimination once or twice a year by a method more or less agreeable, but which would not be necessary had food suitable to a sedentary life only been taken. Many a man might indeed safely pursue a sedentary career, taking only a small amount of exercise, and yet maintain an excellent standard of health, if only he were careful that the "intake" in the form of diet corresponds with the expenditure which his occupations, mental and physical, demand. Let him by all means enjoy his annual pastime, and profit by it to rest his mind and augment his natural forces, but not for the mere purpose of neutralising the evil effects o habitual dietetic wrong doing.

It is for this large and increasing class of the community, who are emphatically brain-workers, that fish furnishes an appropriate food; and when we reflect that the tendency of civilisation here and elsewhere is slowly but surely to develope mental activity, and to dispense with laborious handicraft, that all advance in individual as well as corporate well being is commensurate with, and indeed is effected by the substitution of brain-work for mechanical labour, we may see in this great and systematic investigation of the world's fish supply, a notable sign of the times. I regard it as a natural and necessary product of an advancing civilisation, as the inevitable result of the age and its needs, and certain to have been evolved thereby sooner or later.

A form of food which exists in unimaginable profusion on our own shores; one which has been hitherto for the most part but an agreeable appendage to the daily table of a few, ought I think to be more generally recognised as peculiarly adapted to the wants of a very large, influential, and increasing part of our population.

For the sedentary man, whatever his calling in life, whose engagements permit him only to take just that moderate amount of muscular exercise which is in all circumstances essential to health; for a great proportion of women whose habits mostly are not, and often cannot be active, the nutritive elements afforded by fish admirably supply an important part of the wants of the body. The moderate amount of flesh-forming material present in fish, and in a form which entails little labour on the digestive organs—for most persons certainly less than meat—and the facility with which fish may be associated with other elements—fatty matters, or cereal and vegetable products—place it in the first rank of foods in that mixed dietary which is suitable to those who lead more or less the kind of life referred to. I by no means say that it should supersede the use of meat altogether, although it may do so sometimes with advantage; a point only to be determined in each individual instance after some observation and experiment. For in all cases, it is to be remembered that no man who has habitually eaten meat two or three times daily can at once exchange it for fish and cereals or vegetables, without some discomfort, to say the least. All radical changes in diet require to be gradually made: the stomach conforms slowly, when long accustomed to deal with highly nitrogenised animal food, to the task of deriving from different materials the support necessary to the body. Given time for such modification of function, and it is remarkable—at least it appears so to those who have not practically studied the subject—that a diet which, if adopted suddenly might be equivalent to semi-starvation, may by degrees become the most healthful and nutritious which the individual can adopt.

I may here advert to a belief which appears to be very widely entertained, viz., that fish contains certain elements which adapt it in an especial manner to renovate the brain, and so to support mental labour. There is no foundation whatever for this view: the value of fish to the brain-worker is due simply to the facts already referred to, viz., that it contains, in smaller proportion than meat, those materials which taken abundantly demand much physical labour for their complete consumption, and which without this, produce an unhealthy condition of body, more or less incompatible with the easy and active exercise of the functions of the brain.

I must merely advert very briefly to the subject of climate and temperature, as bearing on the question of fish as an article of diet. Time will permit only the remark that the greater the exposure to cold, the larger must be the amount of fatty matters contained in the diet; hence the large use of fish oils by the inhabitants of the arctic shores. While in hotter climates than our own, as among the populations occupying much of the Mediterranean coasts, a little fish suffices in addition to cereals, vegetables and fruit, together with olive oil, to supply an amply sufficient dietary.

The question of age in relation to food, respecting which a volume would be necessary for the adequate consideration, must also be rapidly glanced at here. During the period of early growth, the supply of food both in nature and in quantity must be selected to correspond to the demand. During the period of middle life, that of maximum activity of all the functions, the nature and amount, as already intimated, of that activity must govern the selection of our dietary on principles which have already been explained. Then inevitably comes with advancing years the stage of diminished force, diminished activity, and the love of rest and quiet. The popular belief holds with curious tenacity, that the failing power of age demands increased sustenance by food. This erroneous doctrine ignores the important fact that sometimes the digestive powers, but more generally and obviously still, the ability to eliminate food unnecessarily consumed, are notably diminishing. Hence the appearance of a crowd of chronic troubles peculiar to the latter third of life, and to a great extent avoidable. So far from continuing to select the strong nourishment which may have been necessary during the toil and anxieties of thirty years or more of adult energy and activity throughout the prime of life; the elderly man who desires to preserve fair health and to attain to longevity, should gradually diminish his use of strong nitrogenous and much fatty food. He should substitute a lighter dietary; one in which the best forms of fish may suitably hold a conspicuous place. He subsides naturally, and more or less gradually into the class of the sedentary, and adopts the regimen best adapted thereto.

We have now to consider what are the different kinds of fish which are available as food on or near to the British shores; and what are the leading characteristics of some of the chief varieties.

I may remark that the list of fish in general demand by the public is a restricted one. The force of habit, together with the entire absence of inquiry or curiosity on the part of our countrymen in relation to diet, has led to a conventional usage, limiting greatly and disadvantageously the variety of fish which would otherwise arrive at the market Sole, whiting, mackerel, cod, salmon, turbot, trout, smelt, and red mullet, form a group to which a large proportion of British households in purchasing fresh fish as a rule strictly limit their orders. Again, at almost every hotel, coffee-room, or public restaurant here, and whatever the hour of day, it is rare indeed if the waiter summoned to an applicant demanding fish does not first suggest the inevitable fried sole, whatever else he may have to offer; and it is generally accepted as probably the safest order to give, and the most likely to be promptly executed. No desire for variety in material, or in cookery is manifested, for if the host suggested something less familiarly known, a troublesome doubt as to his motive would probably be aroused in the mind of the guest.*

To return to the list of fish just given, it may be remarked that the sole, the whiting and the smelt are the most delicate in flavour, contain the least nutritious matter, and are the easiest of digestion; fitting them admirably to the invalid commencing after illness to make a trial of solid food; the two former being also susceptible of very varied treatment in high class cooking for the production of elegant entrées. The turbot, rightly esteemed, is stronger food and agrees well with most persons. The cod for some is not quite so readily taken; but is not only more palatable but is sometimes more easily assimilated when "crimped." The same may be said of the salmon, a leading characteristic of which is the presence of fat. This element in fish is more apt to disagree with the stomach than fat from other sources; and on this account it is, that many either avoid, or eat sparingly of salmon. As the fat is chiefly found in the underside of the fish, a slice from the back only should be taken by such persons; and in the fresh crimped fish the fat is in a more wholesome state than when on the second or third day after leaving the water it becomes oily and acquires a slight characteristic taste and odour.

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* Since writing the above, I have learned that in the fish restaurant here, a similar experience has been met with. Notwithstanding the efforts of the accomplished lady superintendent to introduce to the public new modes of cooking fish, curries, stews, &c., she informs me that these have been entirely neglected, and among the thousand or more daily visitors, three-fourths demand fried fish, and the other fourth take it boiled, or rather steamed.

One word about the crimping of fish; I am glad to be able to state not only that the process of crimping does not require the animal to be alive, for its proper performance, as some have stated, but that as a matter of fact the operation is not done on the living fish. Were I not satisfied on this head, I would not give any countenance to the practice.

The mackerel is another oily fish, and it disagrees with some persons accordingly; so is the red mullet, but the oil is chiefly in the liver, and gives the fish its peculiar flavour and value.

The second list of fish I shall call your attention to is headed by the Dory, an admirable fish with a peculiar firm, short, flakey and very white flesh, belonging to the first rank in all respects, and not sufficiently appreciated. The brill, the grey mullet, the haddock, the fresh herring and the flounder follow, all excellent food, and wanting only proper treatment in the kitchen to make them very palatable, of which a hint or two presently. Then the herring, the pilchard and smaller varieties of the family, by reason of their abundance, the facility with which they are preserved, and of the fat which they contain, furnish large supplies of useful food not only here but to other European populations. Next in order the skate and the plaice, of which the same may be said; while their price also brings them, or should do so, within the range of the working man; in nutritive qualities they rank much higher than the sole and whiting.

But besides all these there are fish, which may be placed if not in the first, yet certainly in the second class, which are practically unknown, I will say, to ninety-nine out of every hundred London housekeepers. I shall name first the Wolf-fish, or Cat-fish, which, although unlike in appearance to the usual occupants of a fishmonger's shop, is a white fish, of excellent quality. It lives almost entirely on crustacea, a circumstance, as Yarrell long ago pointed out, always associated with excellence in the fish so fed. The superiority of the cod caught at the Dogger Bank is partly due to the same cause, as their food at this spot is largely crustacean. The halibut, from the North Sea, closely related to the turbot, is good and substantial food, and when large, as it often is, is also very cheap. The sea-bream, not unlike a large freshwater perch, and the basse, which has been sometimes styled a white salmon, are both useful varieties which have never received the attention they deserve, and which may be presented simply yet effectively at table. The gurnard is much better known, and an excellent dish may be made with it. Among cheap fish, which might be obtained in any quantity and at a very small price, are the ling and hake, related closely to the cod, but chiefly used at present as salted fish and exported; the thornback, of the same family as the skate and equal in quality; the pollack, a substantial whiting, and the coal-fish, of the same family, but second in order of quality, are both good when in season; a proviso which, it is to be remembered, applies equally to every variety.

I shall but enumerate the conger — excellent and nutritive for soup and stew making, and one of the best materials for making the stock of turtle soup; the turtle often furnishing only the garnish and the name;* the whole tribe of eels with their abounding fatty constituents; and the sturgeon with a flesh approaching in quality nearer than any other fish to that of meat; besides all the fresh-water fish, such as pike, tench, perch, &c., of which the supply is, by comparison with sea fish, limited; following on which there is still a large number of minor fish which it would be tedious to particularise. I feel certain that the result of the interest and inquiry aroused by this Exhibition, together with the opening of new fish-markets, will make us all more familiar with many yet untried and valuable products of our shores, and especially with the richer and better stores which populate the "deep sea," a region which may be regarded as lying between fifty and three hundred miles distant therefrom.

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* A more explicit statement is now necessary than that made in the first edition, where a slight allusion, in two lines, respecting the value of conger as a basis for turtle soup, produced a lengthened, energetic, and amusing discussion of the whole turtle question in the daily press.

The facts of the case may thus be summed up:—

First: Turtle soup may be made entirely from imported "live turtle;" the "Calipash" and "Calipee" forming the garnish of the soup, and the inferior parts of the animal being solely employed to make the stock or basis.

Secondly: The "live turtle" may furnish the "Calipash" and "Calipee," as in the first method, and the stock may be made of beef and veal, with or without some use of the inferior parts of the turtle. Thus it is the custom at a well-known London club, and I believe in other large kitchens, to use 20 lbs. of meat to a 50-lb. turtle.

Thirdly: The "live turtle" may form "Calipash" and "Calipee" as before, and the stock may be made of fish instead of meat, which is perhaps the most perfect form of all, and that which was originally so described in the text. No better fish than the Conger could be supplied; few, indeed, are so well adapted for the purpose.

Fourthly: The imported "dried turtle," which is now very largely used, almost invariably forms the garnish to a veal and beef stock, as recommended in the printed forms supplied by those who sell it. It might be advantageously combined with the conger or other fish stock, as in the preceding class.

I shall now make a few general remarks on the practical treatment of fish in preparing it for the table. Our observations will commence at the point at which the fish leaves the fishmonger's scale, or if not weighed, has been valued to the purchaser, and has become his property. Before entering into his possession, however, it first undergoes the process technically known as "cleaning." This differs considerably according to the fish to be dealt with, but in all cases it involves the loss of what is often a valuable portion of nutritive matter. The gills, liver, intestines, &c., are first removed, often some skin, then portions of the fins, sometimes the head also. All these are known as "cuttings," and are sold at a low price to the poor, at the close of the day, many of whom, I am happy to say, appreciate their value and profit thereby.

To illustrate the result of this process for the purchaser, let us see what happens in one instance, as an example, no doubt an extreme one, but nevertheless occurring daily in every fishmonger's shop. A pair of soles is bought and ordered to be sent home in fillets: eight fillets accordingly arrive. The soles were first skinned, the internal parts taken out, after which a long fillet, consisting of all the flesh on either side of the central bone, both front and back, was removed, making four from each fish. The whole skeleton, with the head, fins and tail, forming an entire piece, remains as "cuttings" in the shop. Now this piece will be found just equal to the fillets in weight, and is in fact one half of the fish; and it will make excellent stock for soup, a form of food greatly neglected in this country. I have an illustration of this here, for the purpose of showing what a large amount of waste occurs not only at the purchase, but may also subsequently be incurred in the kitchen. For in utilising fish, as far as possible, and in circumstances where a strict economy must be regarded, the soft part of almost any fish may be cooked apart, so that the skeleton, head and fins may be utilised for stock, these parts being of course useless for that purpose when already cooked, as by boiling, frying, &c.

A soup, or what is better a stew of fish, may be made in a very savoury and nutritious form for the working man; or it may be presented as a delicate and attractive dish for an experienced palate. It is not within the narrow limits of this paper to furnish details for either product, but the subject well deserves to be practically studied, and especially in relation to the charitable soup-kitchen, where fish may thus prove of great value, as well as for other gastronomic purposes. I have recently had an opportunity of seeing the Department of Practical Cookery here, and can testify to the excellent work which has been carried out in the direction indicated. The less esteemed kinds of fish already referred to, when better markets and improved modes of distribution exist, will abundantly furnish the means of producing a nutritive dish at a very small cost, especially in the colder season of the year.

I shall, before closing this paper, venture to offer a practical suggestion or two in reference to preparation of fish for the table, which, considering the terms of our subject, appear to me to be sufficiently important to be brought under your notice here, and to which your consideration may be fairly invited. I think it will be universally admitted that, according to the present usage adopted by the majority of consumers in this country, the bulk of our fish is cooked almost invariably by one of the three following methods:

First, it is simply boiled, in which case it is served with a liberal supply of some butter sauce, often associated with a minor fish product for the sake of flavour.

Secondly, the fish is fried either whole or in portions, and is eaten with or without butter sauce, or with the juice of a lemon, or that of the mushroom, or with some composite ready made sauce.

Thirdly, it is broiled, and is served pretty much as in the preceding mode; but occasionally, and this relates to a few exceptional varieties, it is baked, and some form of seasoned forcemeat is served with it.

By all these methods, but particularly by boiling, some waste of nutritive material occurs. Relative to this I have made numerous experiments, and I find that the loss in weight by boiling varies with different fish, and also with the mode of operating. It is rarely as low as five per cent., it is generally much more, and I have known it to reach thirty per cent., the water always containing more or less solid animal matter. In order to avoid waste as much as possible, the fish should be placed in a relatively large quantity of water, which should be boiling. The liquor in which the fish has thus been cooked, I have evaporated, and have obtained from it, in solid deposit, no less than four per cent. of the original weight of the fish; a very startling quantity. There is no doubt then that steaming is a more economical process than boiling, which in my opinion ought to be discarded altogether.

But I now desire to call your attention to another mode of cooking fish, which ought to be general, since it is applicable to all varieties, and has the advantage of retaining all the nutritive material, while the juices and the characteristic flavour of the fish are preserved in a manner not attained by any other process. It is very rarely practised, simply, I believe, because any other than stereotyped methods in cookery are always regarded with suspicion, and are very slowly adopted by the public, until attention has been thoroughly aroused on the subject. The opportunity offering a few years ago, I advocated its occasional use, but I wish now to show how widely it is applicable, and how well it deserves at least to rank among the other and better known modes of preparing fish. It consists in placing the fish, after the usual cleaning, entire, if of moderate size, say from a sole to a small turbot or dory, in a tin or plated copper dish adapted to the form and size of the fish, but a little deeper than the thickness of it, so as to retain all the juices, which by exposure to the heat will flow out; the surface is to be lightly spread with butter, and a morsel or two added; the dish is then to be placed in a Dutch or American oven, or with some other screen to reflect the rays of heat, in front of a clear fire.* The advantages of this method are, that the fish is cooked entirely in its own juices, which are abundant, and form the best sauce, and that these juices which contain part of the nutriment and much of the characteristic flavour are saved and utilised; lastly, the direct action of the fire browning the surface of the fish, gives that peculiar and appetising flavour which is the especial charm of the

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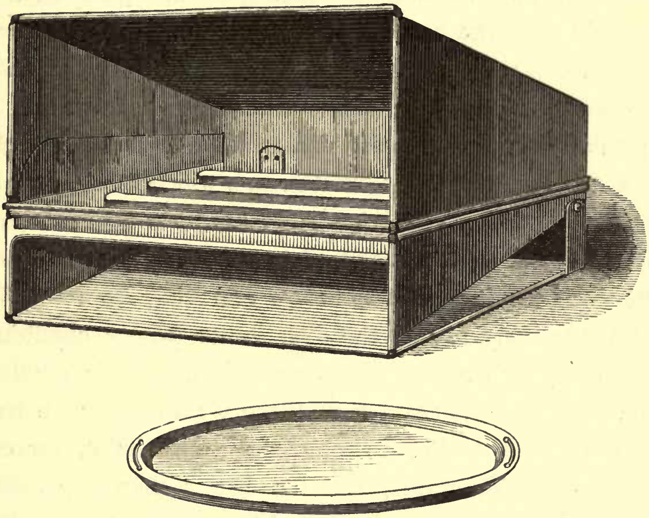
* Mr. W. Burton, of Oxford Street, has been good enough to send an oven or two, and some dishes, which he has made expressly for me, suitable for cooking fish before the fire. The oven is a modification of that known as the "American," being rather deeper, from before backwards, and much shallower, from above downwards, on account of the flat form of fish not occupying the space which is required by joints of meat.

"roast" and the "grill," and which is known to appreciative palates as "tasting of the fire." In fact, the proper term for denoting the method described, is that of "roasting," for the fish is literally roasted before the fire and basted in its own gravy; and with the same



SKETCH OF OVEN ADAPTED FOR COOKING FISH BEFORE THE FIRE.

The size from which the above was taken is 18 inches in length; 16 inches high at the front or highest part. It is 13 inches deep from before backwards. There are four bars in the middle on which the dish containing the fish is placed. The dish seen below is intended for a small turbot, brill, or dory, and is about 17 inches long by 12 inches wide, including the rim, which is 1 inch wide, and is about 1½ to 1¾ inch deep.

(Smaller sizes than the above are made.)

advantage in result as that which roasted meat possesses by universal consent over that which is baked in an oven.* When served at the table the fish remains of course on the dish in which the cooking has taken place The method is susceptible of innumerable variations to accommodate different tastes. Portions of fish prepared as fillets may be treated as well as entire fish; garnishes of all kinds, as shell-fish, &c., may be added, flavouring also with fine herbs and condiments, according to taste. I may add that the process may be conducted in an oven, where a clear fire is really not to be had, which is then of course ordinary baking; but this is apt, unless watched, to dry the fish unduly; or the dish may be first placed in the oven, and be finished before the fire, which is better. If, however, by either method, the fish has been overdone and so becomes dry, the addition of a few tablespoonfuls of any pale stock, a minute or two before removing from the fire will very nearly restore the dish to its proper condition. Cooked by this method, an agreeable change is afforded from the ordinary modes and the receipt may be welcome at any table; in preparing red mullet, for example, it is inimitable, and far better than any other mode for preserving their own rich gravy and admirable flavour. On the other hand, an ordinary fresh haddock split and thus prepared is, perhaps, better served in this than in any other way, and may take higher rank than hitherto. But the working man also can thus advantageously cook before his kitchen fire, in a common Dutch oven, some fillets of plaice or skate with a slice or two of bacon; the dish to be filled or garnished with some previously boiled haricots, and by this means

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* Mr. Grove, of Charing Cross, to whose great practical knowledge of all matters relating to fish, especially in regard of its fitness for the

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table and of the art of presenting it there, I have long been indebted, advocates the method above described. as the best for most kinds, and as worthy to take its place as a welcome variation, in turn with those processes of cooking which are more generally practised.

secure an economical and savoury meal, which is in the highest degree nutritious. This is but a single illustration among many which might be adduced, of what may be done by this simple method for those whose resources are of the slenderest kind.

The limits of time allotted to this paper have now been reached. In bringing it to a close, I must confess how difficult I have found the task of treating so large a subject within so small a compass as that which has of necessity been assigned to it. No one can feel more keenly than myself how inadequate is this attempt to grapple with the several questions which naturally arise in considering the fitness of fish as food for man. Should a practical hint or two of any value have been furnished, or should fresh light on the subject be evoked thereby in discussion, I shall be well content to have had the privilege of offering a slender contribution towards the furtherance of an object, for the accomplishment of which are associated, in active and disinterested labours, so many of the noblest and of the most illustrious of our time.

DISCUSSION.

Dr. **COBBOLD** thought there was no necessity for the modest apology made by Sir Henry Thompson at the end of the Paper, for not being able to do full justice to the subject. In the short space of time allowed he had succeeded in giving an immense amount of useful information, but as he himself had pointed out there were some phases of the subject with which it was impossible to deal, such as the danger of eating fish on account of the organisms to be found in some of them. There had been no less than a dozen small parasites in fish described as trichines and people had been unnecessarily alarmed at the danger of getting trichinosis, but the fact was that these so-called trichines were the immature forms of a higher parasite well known to them, and persons might swallow any quantity of them without any evil effects. In the Basque provinces they actually collected the small vivaria under the impression that they were really small fish and ate them with deliberation and relish ; and in Italy the "maccaroni prati" was considered a most toothsome dish. The important question was whether there were any parasites in the human frame arising from eating fish, and to that question the answer must be given that it was possible to contract an important and injurious parasite by eating some of the salmonidæ in an uncooked state, because it had been shown that we must look to the salmon and trout family as the source of the great tape worm. There was, however, very little ground of alarm ; all they need do was to be sure that the fish, in cooking, was raised to a temperature of 120 degrees, when the parasites would be destroyed however numerous they might be. He might further add by way of encouragement to those who still had their fears, that every kind of parasite had its particular territory and if it were possible to swallow a thousand different species, no harm could possibly result, unless they happened to swallow the particular one that could live in the human territory. Needless alarms had been spread on that point which he hoped would shortly be allayed.

Mr. KENNETH CORNISH said he agreed with Dr. Cobbold that there was no danger—or very little—to be apprehended from the presence of parasites in fish, but he thought some caution ought to be exercised to prevent danger from poisoning. His namesake, who read a Paper on the previous Friday, had alluded to the poison present in green mackerel, and in the West Indies poisoning among the negroes was exceedingly common from eating the barracouta and yellow bill sprat. The only thing which seemed entirely to destroy these poisonous effects was thoroughly drying and salting the fish.

Mr. WILMOT (Canadian Commissioner) said he had listened with much attention to Dr. Cobbold's remarks, but he was of opinion that the parasites referred to were in the fish at a time when they might be called foul or unclean, or unfit for human food—at any rate they predominated in them during that period. If they were only to consider that there was a time for eating fish, as there was for any other food, when it was in a proper condition they need not be alarmed at these parasites, but unfortunately large quantities of fish were caught in an unfit condition, their abdomens distended with the ova. Was it not a fact that they had laws forbidding the killing of salmon in that state; and no farmer would be allowed to bring into the market a beast that was far advanced in pregnancy. Fish were out of sight, and therefore to a certain extent, out of mind, but they laboured under the same difficulties as the domestic animals, and it was the duty of man to protect them during the breeding season.

Professor BROWN GOODE (United States Commissioner), in moving a vote of thanks to Sir Henry Thompson, said he considered the Paper was the most important that had been presented. Many of the other papers had been of great interest to certain localities, but this was of great importance to every part of the world, and he hoped it would be translated into many languages. He was sure that his own countrymen would read the paper with much interest. It had been suggested that there were many fish in the English waters which were not properly appreciated, and he might mention that in New York they had a society called the Ichthyophagus Club consisting of intelligent and philanthropic gentlemen who met together once a year to dine upon fish and it was customary to have new kinds of fish brought forward and cooked by the best cooks. Through the agency of that organisation quite a number of valuable fish had been introduced to the knowledge of the public at large, and the influence upon the fish trade of the United States had been very considerable, and he thought something of the kind might be useful in other countries.

Mr. ALFRED JARDINE seconded the vote of thanks, which was put and carried unanimously.

Sir HENRY THOMPSON, in reply, said he should have very little to say because the discussion had not been such as to require further remarks from him. Professor Cobbold was the highest authority in this country on the subject of all parasites affecting the human body, and he was only too happy to learn from him how little they had to fear on that point in eating fish. He desired to repeat, lest he should have been misunderstood, that he was not an advocate for an exclusively fish diet for any one. Nor did he think that it was wise to limit our resources, in choosing our food, to the products of either the vegetable or the animal kingdom alone. The whole of these should be at our disposal, and it was for man to decide for himself what form of diet was most suitable. The wants and the circumstances of the human race are so varied, and individual constitutions so widely different, that dogmatism in the matter of diet was, in his opinion, a mistake. Thus, two persons might sit down and eat exactly the same meal and the one would derive a great amount of nourishment from it and the other scarcely any. But relative to the particular topic of to-day, he would venture to suggest that most people who did not take a great amount of exercise would, as a rule, act wisely by eating less meat and more fish. In conclusion he moved a vote of thanks to the Chairman, which was carried unanimously.

The CHAIRMAN, in response, said he was grateful for the way in which the motion had been received. When they considered that in a few days the important paper to which they had listened would be published and issued throughout the world they would see what an immense amount of good would ensue.

THE
PRESERVATION OF FISH LIFE IN RIVERS
BY THE
EXCLUSION OF TOWN SEWAGE.

BY

HON. W. F. B. MASSEY MAINWARING.

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CONFERENCE ON MONDAY, 16TH JULY, 1883.

PRESERVATION OF FISH LIFE IN RIVERS BY EXCLUSION OF TOWN SEWAGE.

The Chair was taken by **FRANCIS GOULD**, Esq., in the absence of the Marquis of Hamilton, who had sent a letter saying he was compelled to leave town. The Chairman said he was much interested in this question; and had only recently attended a meeting on the same subject, which was one intimately connected with the work proposed to be done by this splendid Exhibition. Mr. Mainwaring was the Chairman of the Aylesbury Native Guano Co., whose works he had several times had the pleasure of visiting, and as a member of the Thames Valley Joint Sewerage Board, he was aware of the work on which the Board had been engaged for many years at vast expense, in endeavouring to free the Thames from its pollution. He hoped they would succeed in doing so ere long, and he was quite sure that if ever it were done, it would be by working in the same direction as the Aylesbury Company. They had tried irrigation and diversion, but the Board had come unanimously to the conclusion to try chemical treatment. The importance of this question was palpable to every one who had considered it, and he hoped when this paper had been read it would be still more palpable to the public at large.

The Hon. W. F. B. MASSEY MAINWARING spoke as follows:

It may occur to some present here to-day that I ought to give some reason for appearing before you to read the Paper with which my name is connected. The only excuse I can give for asking your attention for my feeble effort is, that when the Norwich Fisheries Exhibition was in embryo, I suggested that one of its classes should be devoted to exhibits for the best means of rendering our rivers and streams free from the pollution of town sewage.

A large number of scientific gentlemen, among others him whose name was, and is still, I believe, a household word among every assembly of men interested in our fisheries, I mean the lamented Frank Buckland, have held that one of the causes of the fish epidemic that is rapidly depopulating the finny tribe in our streams, had its origin in the dangerous germs produced by the putrid and excrementitious matter allowed to enter in large quantities into our rivers and streams, and I was, therefore, very anxious to prove that if there were any remedies existing, they ought to be more widely known through the medium of a public exhibition. I am well aware that I shall be met by this remark: "You are about to tell us of remedies to be applied; but first prove that our rivers and streams are in a sickly and unhealthy condition before you propose a prescription that may be entirely unnecessary; and even admitted that the waters are in this insalubrious condition, are they dangerous and antagonistic to fish life as well as human life?" Both these propositions are, I regret to say, fiercely contested. It might seem nearly ridiculous for me to take up your time by endeavouring to prove the pollution of some of our waterways, if it were not that at this moment a Royal Commission is sitting in solemn conclave to determine whether our metropolitan river is "a limpid translucent crystal stream," or in the same condition as—

"The river Rhine it is well known,
Doth wash your City of Cologne;
But, tell me, nymphs, what power divine
Shall henceforth wash the river Rhine?"

But the subtle advocates of the purity of Father Thames and many other rivers, I dare say, will tell us, "Oh, we know they are polluted; but they are not dangerously impure!" I ask these said gentlemen the following questions: Are we to await some fearful epidemic to bring us to our senses, which would indeed force the responsible authorities, at the point of the bayonet, to cease polluting our waters? Are we to wait until the obdurated nasal organs of these doubting officials can count—

". . . two and seventy stenches,
All well defined and several stinks?"

or, are we to take the preliminary warning that the Almighty seems to me to be giving us? When waters cease to be a healthful natural element for the salmon and trout, they surely must have in their composition some impurities that are dangerous to the thousands of human beings, and also the herds of cattle that slake their thirst from these once limpid, but now polluted waters.

Two frightful catastrophes have lately taken place, and the hearts of Englishmen have bled for the childless ones of Sunderland, and the widows and fatherless of Glasgow; surely these poor forlorn ones have our deepest sympathy; but great as this fearful hecatomb has been, can it be compared to the annual (and I insist preventible) slaughter daily going on within our shores, with the thousands cut down in our midst in the prime of life, by those now unresistless miasmas that unseen strike death into their victims?

I wish some society would placard the walls of every town with the number of deaths that occur from unsanitary causes; how quickly this would bring the authorities to their senses, who, perhaps, never even hear of the daily but isolated mortality occurring in their localities!

In the same way, and as an incentive to that action, that will be the means of saving both animal and fish life; let every fishing society procure records of the number of dead salmon and trout found in their respective districts, and let the press proclaim that waters that can produce such results are impure and unfit for man or fish, and that when the means exist to render the filthy clean, the public should demand that what is feasible must no longer be delayed in being put into operation.

Can these questions be answered in the meantime?—

Is the Thames polluted? Ask those who live at Greenwich, Crossness, Deptford, Tilbury, and Barking! Ask the great shipowners! Ask the myriad craft that daily ply upon the river below London!

Is the Clyde polluted? Is the Mersey? Is the Irwell? Is the Aire? Is the Wye? Can their impurity be denied? What would old Izaak Walton say if he could witness the condition of the streams where once he was captivated by his fascinating sport?

A meeting was summoned lately to discuss the polluted state of the Wye, which was till lately well known for its fisheries; I therefore propose to read a short extract from the report of the meeting, taken from the *Field.*

"The meeting was largely attended by the influential riparian owners of the neighbourhood and many other gentlemen.

"Mr. Millar, a fishery lessee, Newport, reported that there was no sign of the salmon disease in his district, in fact the fish were in excellent condition, not having been fed on Hereford grounds. (Laughter.)

"Sir Henry Scudamore Stanhope said that a gentleman who was fishing on his estate had told him that the water was so offensive that it took him a week to get his waders sweet again;" and then Sir Henry made use of this very wise remark: that "water ought to be kept pure for the use of mankind." I only wish his desire could be accomplished more rapidly than it is likely to be.

A gentleman named Stephens then related "the experience of his workmen, who had seen hundreds of large trout and grayling dead in the river below Hereford, and they reported that the stench on the banks of the river was abominable." He also added a sentence that, I trust, the authorities of towns will take home to themselves; he said, "If fish were killed in their natural element, the water was certainly not healthy for people and stock to drink."

A Mr. Lloyd said "they could not ignore the fact that the sewage of Hereford and other towns" (I will add, of every town allowing its sewage to flow untreated, or, what is even worse for the fish, badly treated by the use of lime, or badly worked sewage farms) "was doing immense injury to the river; and he thought the time had arrived when the Board ought to tackle this great evil, or say that they were not prepared to do so; or if they were, let them put the existing law in force."

Many other speakers bore testimony to the polluted state of the river, and the following resolution was passed: "That in the opinion of the board the pollution caused by the sewage is most injurious to salmon and other fish in the River Wye, and the board requests the executive committee to take immediate steps to enforce the provisions of the Rivers' Pollution Act."

I have troubled you with these lengthy quotations from the above meeting as being the most recent press report that I have been able to trace of a polluted river, and of the effect of sewage upon fish life, although I am well aware that many other rivers have equal if not greater death rates among the inhabitants of their waters.

I shall be asked, I dare say, Why do you not tell us of the condition of the rivers upon which our larger towns are situated? The answer to this query is self-evident to every angler. In most of these, the glory of their names as salmon and trout producing rivers, have parted from them long ago, viz., when first the towns upon their banks grew to such an extent that these delicate fish could no longer withstand the volume of impurity that was entering their confines. I need not prolong the enumeration of rivers polluted more or less, and which must of necessity increase each day in the extent of their pollution as the population multiplies by leaps and bounds. Some rivers, no doubt, are only in the first stages of pollution, and others are, and have been for some time, in the most dangerous stage, and can be justly said to deserve to have the same words addressed to them as a poet has sung to one of the noble rivers of Scotland—

> "My native Clyde, thy once romantic shore,
> Where Nature's face is banished and estranged,
> And heaven reflected in thy wave no more."

Now we come to the next proposition, which is not so self-evident as the actual pollution of the rivers. It is this: "Is a river contaminated by sewage dangerous to fish life?"

The answer to this question should run thus: The extent and volume of the pollution must be taken into account. Take a parallel case. It is pretty generally known that lime water is inimical to fish life; a fish put into lime water dies immediately; but take a small quantity—say, two ounces of quicklime—and place it in a river well stocked with fish, and you will find no result from so small an amount; then gradually increase the dose, and you will arrive at the weight of quick lime that will kill all the fish in the nearest pool to where the quicklime has been put in. And so on, if you put a very large quantity into the river you would for miles kill all the fish it contained. I remember, some years ago, out of spite, a very large quantity was put into an Irish river, and for miles every fish was killed. Now apply this simile to sewage pollution: put a delicate fish into raw strong sewage, and he will very soon die; yet a small quantity of sewage allowed to run into a river has no effect, but the moment you pass the amount the fish can withstand they will become sickly and eventually die. From the meeting at Hereford you will have noticed that at distances remote from the actual source of contamination, no damage occurred to the fish in that part of the river, although below the sewage inlet. How is this? The solution of this difficulty may be thus explained: Rivers are supposed to have the power of cleansing themselves after their polluted waters have travelled a certain distance, although this inherent power is valuable only so far as the fish are concerned who inhabit the part of the river perhaps thirty miles below the source of pollution. Of course, this never could be an excuse for the continuation of pollution by our towns, as the stench that is emitted during this self-cleansing process is very dangerous and offensive, and before self-purification is effected the distance travelled over is considerable.

The following interesting experiment has been lately made by Mr. J. W. Slater: He took three kinds of water; (1st) raw undiluted sewage obtained from Aylesbury; (2nd) similar sewage partially purified; and (3rd) sewage fully purified as it passes from the works of the Native Guano Company into one of the branches of the Thames. The sewage in question is strongly animalised, containing, in addition to the usual excrementitious matters and liquid household refuse, a somewhat unusual proportion of blood derived from the cattle slaughtered in Aylesbury for the London dead-meat market. Of each of these three kinds of water, the one half was filtered, and the other left in its original state. He had then six kinds of water. He then placed each portion in a white glass pint-bottle loosely stoppered, and arranged on a shelf exposed to the morning sun. In some of the bottles the stratum of water was 1½ inches in depth; in others 3, 4, and up to 6 inches. He now regularly examined the bottles, to take note of the changes that would take place. In the bottle containing the best purified water a green confervoid vegetation appeared in a couple of days; it increased, and bubbles of oxygen were formed and rose to the surface; there was no offensive odour. Similar phenomena were observed later in the other bottles; but eight weeks passed over before green vegetation appeared in the bottle containing 6 inches in depth of raw unfiltered sewage. In the meantime, the odour given off from this bottle had been very offensive, and a small quantity of white sewage fungus appeared, which was gradually burnt up by the oxygen liberated by the green vegetation.

Mr. Slater then draws the following conclusions from his experiment. He says, the common belief seems to be correct that green vegetation unaccompanied by white fungoid growth is a favourable sign; that sewage can purify itself, but that the process is very slow; that the speed with which the impurities in a water are destroyed is greater when it is spread out in shallow layers to the action of air and light, and where its transparency is not interfered with by suspended matter. He, however attaches little practical importance to this property in sewage, the process being extremely offensive, and such treatment in practice would be ruinously costly.

No doubt the purification would be more rapid if the sewage was in motion in a river, and there found the water plants developed and ready to oxidize the impurities. In some cases the poisons from mining and manufacturing towns would hinder the development of any vegetation in rivers, into which these impurities were allowed to enter, and in these this means of self-purification would be entirely wanting, so far as it was produced by the plants they contained.

These experiments go to prove that all depends upon the extent and the quality of pollution; and where you find a small river and a very large volume of sewage pouring into it, it will have nearly destroyed all vegetation, and one of the principal means of self-purification will only be developed sparingly. But even if it is admitted that self-purification is a fact, there seems to be now little doubt that in the actual neighbourhood of the sewage intake, the fish will in time succumb to an attack that, from our experience of the rapid increase of sewage, is daily becoming more severe. I shall be asked here, How do you account for finding fish near the mouth of a sewer? I dare say they will be found at the mouth of a sewer with a small volume of sewage, but I should like to see them at the mouth of the main sewer from one of our large manufacturing towns. Perhaps they visit the sewer to pick up the particles of human food brought down by the sewer, or perhaps they are lazy fish, too idle to hunt for their food in a legitimate way, so come to the sewer to imbibe a kind of sewer tipple, instead of food, which sooner or later affects their health, and then they regret the over-indulged in excrementious stimulant, that has undermined their constitutions. But the end is the same, I presume, with these dipsomaniac fish, as it is with all the higher species—

> "The ruling passion, be it what it will—
> The ruling passion conquers reason still."

But I shall be asked, "How do you account for your assertion that fish cannot long exist in water containing large quantities of sewage?" It is a well-known fact that fish life is not supported by the oxygen existing in combination with hydrogen existing in the water itself. The oxygen they breathe is the free oxygen which has been dissolved in the water. Let a fish be placed in previously boiled water, in a stoppered bottle unagitated, and it will soon be found dead. This proves that they require this free oxygen for their existence. By analysis, it has been proved that in sewage-polluted water the quantity of oxygen is much reduced, when a comparison is made with an analysis of unpolluted water.

The oxygen, in fact, has been consumed in the changes it has undergone, which nothing but time or aëration by agitation can replace. Thus I have little doubt that in two rivers equally polluted, the one a torrent and the other with sluggish waters, the fish would live much longer in the one than they would in the other. But the contrary might be the case with the human species, for any one would naturally be tempted by the sparkling water of the torrent, and if drunk before the dangerous properties had had time to become consumed, consequences little dreamed of would most probably be the result.

It is in the summer, and particularly if it should be an unusually hot one, that man and beast and fish life will suffer most from the pollution of our rivers. The water then is very low in our streams. At that period, therefore, less surface exists for the development of the chlorophyllaceous growths, one of the means of their self-purification. The same volume of sewage as in winter is mixed with a greatly diminished volume of water, and therefore the sewage pollution is stronger and more dangerous, also the smaller volume of water flows less rapidly, and consequently is not so thoroughly aërated; and, besides, just at this time the ova of the fish are coming forth, and, like the young of every species, are less able to support an impure medium of existence. Without doubt they also suffer from the turbidity of the water intercepting the rays of light so necessary to their healthy growth.

Another question arises when the pollution of our rivers is considered: what effect has the flesh of fish, not only in a dying state, but even in a slightly sickly condition, upon any individual when consumed as an article of food? We all know that the flesh of salmon, when out of season, is not only unpalatable, but dangerous if consumed in a large quantity: I remember a case where the eating of a portion of a spent fish caused vomiting, accompanied by diarrhœa.

Again, one can hardly imagine a more revolting meal than a salmon in the last stages of salmon disease. I should not like to touch one only slightly affected.

A fearful scourge of cholera is now devastating the upper part of Egypt, and it seems to have had its origin among that portion of the inhabitants who almost entirely subsist upon a fish diet.

A vivid picture of the waters from whence these fish are procured appeared a short time ago in one of the illustrated papers.

The waters appear to have borne upon their surface one vast mass of animal and human corruption. What must be the condition of fish who for weeks and months have been feeding on these festering abominations, and are even encouraged by the native fishermen to feed on them for the purpose of their capture? What a hotbed for the development of the worst kind of cholera—the impure waters—the fish caught for human sustenance bloated with their carrion food—and all around one reeking mass of decay! Why, surely around Damietta death must have ridden on every passing breeze. Is it not therefore more than likely that the suggested cause of this fearful epidemic is the true one—a daily diet of fish, fed on putrescent food dried in the sun, and many of these perhaps eaten before the sun had scorched out their liability to putrefaction, if, indeed, any amount of sun rays can render flesh from improperly fed fish suitable for human food?

Have you ever heard that fish caught near a sewer have an unpleasant flavour, and, if kept, will enter into a state of putrefaction much sooner than those taken further down? I am assured of this by competent authority, though I have not tried the experiment myself (I don't regret to say). If this is the case, is it not a most potent argument with which anglers should support an agitation to insist upon our streams and waterways being brought back to that state of pristine purity, when they would be—

> "Deep yet clear; though gentle yet not dull,
> Strong without rage, without o'erflowing full?"

Now to the remedies.

The town authorities thought they had made an excellent case when they only asserted, without contradiction, that there were no known means of purifying the sewage, and that consequently the pollution of rivers was a necessity, and, as a matter of course, the hackneyed proverb jingled on their tongues.

Science then stepped in, and she has put natural forces in action, that lay ready to do her bidding. First she suggested that mother earth should be called in as a purifier, and at once sewage farms began to spring up in various parts of the country, where it was possible to obtain land of a suitable quality (a very important consideration) for a sewage-farm. But many towns "rushed in where angels fear to tread," and are now bitterly repenting their haste, in taking land entirely unsuited from its composition to thoroughly defecate the sewage. Others have taken land suitable in itself, but much too limited in extent, on account of the great cost of suburban property. Others are in this difficulty, that they cannot increase the area of their operations except at a ruinous cost. The great difficulty is in procuring land suitable for a sewage farm. You must have land that would be called a dry friable clay soil; this means generally that it is high-lying, valuable for agricultural purposes, and therefore expensive to buy ; and even if you can buy it, you cannot, in most cases, buy enough to satisfy the wants of an increasing population. I have said it should be dry land, and therefore generally lying at a higher level than the town, that means expensive pumping to get the sewage on to the land. The limited state of most sewage-farms obliges the managers to put sewage upon the land when it requires neither irrigation nor stimulation.

What is the result ? The most successful sewage-farm is obliged to grow hardly any other crop than that gross feeder, Italian rye-grass, and it generally resembles a snipe-marsh more than it does a high-class farm.

I will not even enter on the question whether or no the same plot of land can stand for long a monotonous diet, my private opinion being that what will kill the human being is unsuitable to land. I mean the same food every day. I believe I am correct in stating that it would require the whole county of Kent to treat the sewage of London in such a way that crops more remunerative than rye-grass could be successfully produced. And what then would Maidstone, Ramsgate, Margate, and Canterbury, and other growing places do if London took up their available sewage-farm ground ? if, indeed, it exists near them of a suitable description. Besides all this, I assert that there is not an existing sewage-farm of any fairly large town that is not at times a dangerous nuisance, for the reason that to be otherwise they should be at least four times as large. Let us take London again as an instance of what is to be done to produce a solution of this difficulty : can anyone assert that a sewage farm is practicable for the Metropolis ? It is utterly impossible. As another alternative, we are threatened with an expenditure of two millions of money to carry out what would be disastrous policy—a policy of robbing Peter to pay Paul, by discharging the Metropolitan sewer lower down the Thames estuary. But will the Peters of Ramsgate and Margate, and the hundreds of rising sea resorts fringing the lower Thames and the coast on each side of its mouth, submit to have their salubrity sacrificed to enable London—who ought to be the sanitary guiding star for the empire—to commit a grievous wrong to its neighbours? Will she be permitted again to build up miles of a black wall of pollution in the Thames, whose Styx-like waters are now daily ploughed up by our countless fleets of shipping, or perhaps, still worse, they are obliged to anchor on its fever-breathing waters. Is it possible for fish to force their way through this wall of impurity? No! I have little doubt than when a salmon, more enterprising than his fellows, forces his way even a mile into this filthy barrier, he turns back in disgust, fully convinced that the river, once the home of his ancestors, has ceased, from source to mouth, to be a fit habitation for his species. But if neither irrigation nor a second *Cloaca maxima*, with its daily outpouring of that which in its proper form is a mine of agricultural wealth, can solve the Thames difficulty, how is it then to be overcome?

At this stage I will explain to you a combination of chemistry and one of the powers of Mother Earth. The intelligent experiments of Mr. Sillar ended in a patent being taken out, which is now being worked by the Native Guano Company. This marvellous system, only lately prominently brought before the notice of the general public, is being worked within the confines of this Exhibition—No. 798 in the official catalogue—in a special annexe, where the process is demonstrated in active operation. And why, pray, is this a solution of the difficulty? I invite all those interested to go and judge for themselves—

1.—Because it can be carried on without the slightest nuisance in all its stages.

2.—Because it absolutely complies with all the provisions of the Rivers Pollution Act.

3.—Because it can be adapted to a single institution, or to this vast metropolis.

4.—It is always manageable, and it is easy to detect if its functions are in proper working.

5.—After sending the foul water by its action back pure and limpid into the stream, it retains for the use of the now much hampered agriculturist all those valuable properties of the sewage, not indeed only applicable within the selfish confines of the sewage-farm, but in such a portable form that those near or far from the source of supply are on practically equal terms; and now

6, and lastly.—It produces an effluent in no way dangerous to fish life; as can be seen here in this Exhibition, where fish of all kinds are exhibited, living in the effluent from the foulest sewage, after it has undergone the magic effect of the A B C process.

Gentlemen, I have now shown you, to the best of my ability, both the sanitary and the piscatorial aspects of river pollution, it being nearly impossible to separate them in discussing this (now so generally called), the question of the day. The remedy I have suggested all can see, and seeing is believing; and if they agree with me that it is one easily applied, let them join with us in saying to the river polluters: "so far you shall go, but no farther," we insist upon your taking action, you, having got a remedy easily applied, and just as easily deserted if from any cause it should fail or a better come to light, and, by its adoption, you can never be hampered with unprofitable farming land, purchased at enormous cost.

I thank you all for the kind attention you have given me; many of you I recognise as old strugglers in the sanitary battle; but there are some who have heard me here to-day, who have, perhaps, only just placed their feet on the first rung of the ladder of sanitary reform; let them push on with us, and become "the life-blood of an enterprise," not caring for particular processes, or becoming great respecters of persons, but determined that where pollution reigned once, no matter who is responsible, its name shall be known no more; be it pollution of that element essential to the lives of animals and fishes, or that more essential to the human being. A small black cloud, no larger than a man's hand, is visible on the distant horizon! If some unpropitious breeze should bring it nearer, and it should burst upon or near our shores!—I will ask you this solemn question, Are we prepared to meet it? Have we no skeletons in the sanitary cupboard of this country? Have we not hotbeds ready, not perhaps to give birth to, but at any rate to foster and multiply the germs of that terrible disease that is now striking terror and panic into many a land?

A horrible responsibility rests on the shoulders of us all. We, the public, who should cry out for those Augean stables to be swept; and the authorities in power, who should be up and doing. Even, if necessary, a more powerful Act of Parliament should be passed—it was procured for our protection from the ravages of dynamite—but I say a greater than Dynamite is here, capable of slaying his tens of thousands. The dying fish tell an unmistakable tale. They are the straws that point the direction to which the sanitary stream is flowing. Our hearts should leap to action when we think of what will be our reward! Not that of silver and gold, but the far higher one of having been the means of saving countless lives, which otherwise would have been sacrificed to a preventible cause—a want of sanitary reform.

Don't let us delay, then! Let us imagine we hear the Poet Laureate's beautiful words, warning us—

"... They die in yon rich sky
They faint on hill, on field, or river;
Our echoes roll from soul to soul,
And grow for ever and for ever.
Blow, bugle blow, set the wild echoes flying,
And answer, echoes answer—dying, dying, dying."

DISCUSSION.

The Rev. J. McAlister said there were three questions brought prominently forward in this paper; first, as to the supply of food; secondly, whether the health of the people living on the banks of rivers into which sewage was allowed to flow was affected by it, and lastly and most important of all, could these evils be remedied? Firstly, there could be no doubt the fish was provided by Providence in our rivers, and was there ready for capture, provided we did not interfere with them by the introduction of sewage and other poisonous matter. As to their being injured by sewage there could also be no doubt. He had been a witness before the Royal Commission on this subject and claimed some little credit for having assisted in obtaining the appointment of the Royal Commission. Having given his own evidence he waited a short time to hear the evidence of the next witness ; he was a professional fisherman, and in answer to questions, he said he had not for a long time fished in the Thames above Gravesend, but in former times he used to fish up to Battersea Bridge ; he did not do so now because he could not find any fish. That was conclusive evidence as to the effect of sewage in the river, and he apprehended it was the experience of every one who knew anything about fishing that where sewage was introduced in any quantity it would seriously interfere with the growth and production of fish. On the second question, that which affected the health, he had stated in evidence that he could smell the noxious vapours which arose from the river at a distance of three miles ; and that he could distinguish it as clearly from other smells, such as those which arose from a manure manufactory in the neighbourhood, as he could distinguish the smell of a boiled onion from that of a boiled potato. He had observed for the last twenty years that when the wind blew from the north-east, the direction of Crossness towards Plumstead and Woolwich, the health of the inhabitants gradually fell, and when it changed their health improved. This had become quite a byword amongst the people. At certain seasons, partly in March and October, when the north-east wind blew, there were certain states of health generally manifested, not exactly sickness of any decided kind, but the whole life seemed to be below par—a loss of appetite and lassitude ; and when they went to a doctor he almost invariably gave them quinine. But as soon as the wind changed to the south or west, all this was corrected. He did not suppose there was a man in the country who enjoyed better health than himself, but he always felt the same thing when the wind blew in that direction—that he wanted a trip to Brighton or something to set him up. Now as to the possibility of remedy. He should like some one to answer the question whether any municipality, or any man, or body of men had the right to pour this sewage into a river and poison the inhabitants on its banks? The answer would probably be —We cannot help it; it is a matter of necessity. If it were, he would say no more. Necessity had no law; but was it a necessity? He had taken the pains to investigate the process of the Native Guano Company, and had to thank Mr. Sillar and his subordinates for their courtesy in explaining the system to him and some of his neighbours from the vestry of Plumstead, who went to Aylesbury to examine it. He was convinced from what he saw that the company were able to do all that was required. It was competent to take the whole of the sewage of London, which was now poured into the river at Crossness and convert it into useful manure. He had no interest in the matter beyond a wish to improve the circumstances of his parishioners and neighbours. He had tried the manure on some of his own land, which was very poor, and found it most excellent; he had used it for potatoes, carrots, parsnips and onions, and it produced crops such as he had never seen equalled. In conclusion he gave it as his opinion that an Act of Parliament should be passed rendering it penal for anyone to put sewage into a river.

Mr. WASHINGTON LYON said he also had had the pleasure of going to Aylesbury to see the process in operation, and he drew the conclusion that sewage ought not to be allowed to go into any river in the kingdom. Everyone agreed as to the mischief it did; it was not worth discussing that question, but he wished the paper had given a few more definite facts. The Corporation of London had appointed a committee to consider this question, and they were now fighting the Metropolitan Board about it. They had not yet found a remedy, but they agreed it ought not to go in. He had seen the water running into the river at Aylesbury perfectly pure after the solids were taken from it, but the question was at what expense it was done. He was of opinion that no corporation ought to look for a profit in getting rid of its sewage; they got no profit from sweeping the streets or clearing the dustbins. It was not a question of profit, but of getting rid of a nuisance; and people were prepared to pay any reasonable sum, but they must not pay too dear for their whistle. Only last Friday he went down the river with some other gentlemen to see the state of it, and for miles below Crossness it was polluted by the sewage. It cost a large sum of money to send it into the river, and this, of course, ought to be deducted from the cost of this process, which yielded, he understood, a manure which was worth £3 a ton.

Mr. SMITH thought there was a little omission on the part of the reader of the paper in not referring to the important duties of the Thames Conservancy. They had instituted proceedings, and fined various people for putting sewage into the Thames above London, and it would be a great anomaly if the Metropolitan Board were allowed to discharge sewage into it whilst the people at Paddington, Richmond, Windsor, Oxford, and other towns up the river, were being bound to carry out expensive works to prevent it. The question had been asked, whether any municipality had the right to put sewage into a river. He thought it would be admitted that when the drainage from the Metropolis was under consideration, the Metropolitan Board of Works took the best possible precautions, and went to great expense in getting the best possible engineering skill to design sewerage works at the time chemical processes were not brought to such a state of perfection as they now were. He had also been to the works at Aylesbury on two occasions, and considered they were model works.

Mr. MILNE HOME said most of the speakers had referred to the state of the Thames and to the effect of sewage on fish, but this was a very large question, applicable not merely to the Thames and rivers in England, but to those of every part of the United Kingdom. He came from Scotland, where many of the rivers had suffered in exactly the same way as the Thames, and effects had been produced not merely on the fish, but also on the health of the inhabitants on the banks. A great deal had been said about this subject, and though it did not come under the title of the paper, they had an intimate connection with one another. He remembered when reading the report of a sanitary commission some time ago they asked M. Dumas, the chemist, what was the simplest practicable method of ascertaining the purity of water as fit for human beings and animals to drink, and his answer was that it was not necessary to have any chemical test, but if they put a young fish into the river and it did not live it was a complete proof that the water was not fit for the use of man. It was fortunate that various remedies were known, but the one chiefly spoken of to-day was of a chemical character. Allusion had also been made to the possibility of rectifying sewage and refuse of manufactories by means of irrigation. He had various experience of the mode, and had had the misfortune to be in two actions of law connected with sewage. After studying various remedies he was in favour of chemical appliances rather than any other, for this reason, that however much land you might take for the purpose of spreading liquid manure on the surface to produce crops, in the course of time the land would become so saturated that it was necessary to obtain an additional quantity, which was very expensive. He had not seen the works at Aylesbury, but had read about them, and his son, who had property in Berwickshire, told him that he had visited them, and had tried some of the manure on a small home farm which he had, and found most excellent results from it. He understood the rev. gentleman who spoke first suggested that the laws ought to be of a much more penal character, and he was quite of that opinion himself. He thought it was a criminal act on the part of people to poison those rivers which were intended by Providence for a totally different purpose. In Scotland they had Public Health Acts, some of which contained provisions especially applicable to boroughs and populous places—a populous place being defined as a district occupied by a population of 1200. Under these Acts it was a criminal offence to put any noxious matter into a stream running through such a district, and the offender could be not only fined but imprisoned. That law ought to be adopted for the whole of the kingdom, not only in boroughs and populous places, but everywhere. He lived in the district of a river which traversed three or four counties, and persons on the banks were more or less deprived of the use of it. They could not avail themselves of it for any domestic purpose. This subject, although connected with fish, was also connected with the health and happiness of the whole population. The great difficulty was, who were the persons to enforce the law? He was a riparian proprietor, and hitherto it had been left to individual proprietors to endeavour to stop the pollution of rivers. There had been many cases in the Courts of Session where individuals had come forward at considerable expense, and incurred considerable odium, to stop this pollution, and it ought not to be left in their hands. It was a matter which affected the national interests, and it was the duty of the Executive to appoint public officers to see that this evil was not committed. He trusted that some expression to that effect would go forth from the Conference.

Mr. SURR said this was a subject which came home to them all as individuals and members of a large community living on the side of the large rivers. Being born in London he remembered being taken out as a boy in wherries on the Thames, and the river was then pure between Poplar and Blackwall, where whitebait were found in great quantities, but they were not now to be found below Thames Haven and Southend. He would not go back to the old times when it used to be stipulated by the parents of apprentices that they should not have to eat salmon more than two or three times a week, but he must say that the Thames was now a disgrace to any city, and was gradually becoming worse. He was down the river on Friday, and in many parts there was a most noxious effluvium. Why was the sewage of a city to be continually sent into a river to do so much harm when it might be utilised for the benefit of the country at large? Not only had the Metropolitan Board spent an enormous sum to do a great amount of mischief, but they were going to increase the sum to carry the sewage lower down. He had no personal interest in the A B C Sewage Company, but had had an opportunity of examining the works, and had seen sewage from Aylesbury flowing through a succession of tanks until in the last tank there were fish swimming about in perfectly pure water. He had also seen very fine specimens of vegetables which had been grown with the aid of manure prepared there, and trusted the process would have a fair trial.

Mr. WEBB, who regretted that he had not been in time to hear the paper, spoke at considerable detail of the advantages which he had derived from the use of the manure manufactured by the Aylesbury Company on all kinds of garden produce.

Mr. CHARLES E. FRYER thought every one was pretty well agreed that the river was not the proper place for sewage to be put. Various witnesses had been brought forward in support of the view ; there had been some giant potatoes, and enormous turnips, and miraculous cabbages, and other vegetables, but he would venture for a moment to bring forward the evidence of a witness from the animal world, a fish: the testimony he referred to was taken from the following extract from that day's *Times* :—

"An interesting capture was made a few days ago off Erith, that is fourteen miles below London-bridge. A sturgeon, floating almost lifeless down the river, was noticed by some of the men belonging to Messrs. Callender's Bitumen and Telegraph Company. When dragged to shore, it had sufficient life in it to spout water out at its captors, but appeared to be nearly suffocated, a fact attributed to the sewage which is turned into the Thames at Crossness, about a mile from the works. It is nearly as large as that lately presented to Mr. Parnell, weighing 117lb., and is in length 6ft. 3in. It has been two days on view at the Fisheries Exhibition, but has been removed for a short time for the purpose of stuffing, after which Mr. Callender has kindly consented to restore it to the Exhibition."

He thought the fish must have come up the river on purpose to die on behalf of the people of London. Like a noble martyr it had laid down its life for the benefit of those who would have caught it alive and in health if they could. It had been said that before proper means were taken to prevent railway collisions, a bishop must be killed, but in this case they came very near Royalty being killed, for the sturgeon was a Royal fish ; and therefore, now there was a Royal witness in favour of removing sewage from the Thames, it was high time for everyone else to follow such an important personage, and to insist on the filth being taken out of the noble river, and not only out of the Thames, but out of every other river into which sewage and other pollutions were allowed to flow. 10,000 square miles in England alone, out of 60,000, were utterly destroyed, as fish-bearing rivers, by pollutions of this kind. It was essential that this should be prevented for the sake of the many interests which have been referred to. As to that question of cost, it was not a mere matter of *£ s. d.* how much it would cost to do this, or how much to do that ; the enormous advantage to the health of the populations adjoining must be taken into account, besides the gain the community would derive from having fisheries restored which at present were destroyed, and the enormous advantage of having valuable manure, which, if put on the land, would produce enormous crops instead of being put into the river where it dealt death and desolation wherever it went. As to this particular company he had not the slightest interest in it, but he had watched its career with great interest, having examined the works when first established at Leamington. Comparing the nuisance, as it was called, of the slight effluvium he occasionally perceived in the early days of the process it was nothing in comparison to the stench which arose from the irrigation farm which had replaced it. If, therefore, it was possible to turn sewage into profitable manure, as it had been proved, the 5 or 6 million people in London ought to put their heads together and put their feet down and say they would insist on having the sewage taken out of the river. It was no use for it to be taken out at Crossness, and carried half a dozen miles lower down, nor, as some enthusiastic engineer suggested, for it to be taken 20 or 30 miles out into the German Ocean, where it would not be the slightest good, and would be an injury to those fisheries which the Exhibition had been promoted to foster.

Mr. SILLAR said he should not have said anything on this occasion as what he could have said had been much better said by perfectly unprejudiced and impartial witnesses, but as Mr. Lyon had asked for a few facts he thought it right to say a few words. This process had been in active operation at Aylesbury for some eight years. During those years the water had been so cleansed as to meet every requirement of the riparian owners, and to receive annually a vote of perfect confidence by the trustees of the town; secondly, the works had been visited constantly, sometimes every day, and even at night, by the officials of the town, who bore unanimous testimony to the fact that there never was the slightest nuisance of the kind; thirdly, with regard to the value of the manure, the effect of the severe test, the market price, applied to it was very satisfactory, for the demand was greater than the supply.

The CHAIRMAN then said he should submit the following resolution which he thought would be a very suitable outcome of the discussion: "That it is the opinion of this conference that the pollution of rivers is an evil so serious that stringent measures should be adopted without delay, both by Imperial and local authorities, to enforce already existing Acts, and, if necessary, to amend them." It had been suggested that there should be additional legislation, but he thought there had been too much already, and too little application of it; one gentleman asked the question how it was their municipalities had power to put sewage into the rivers. It had been by the powers of legislation. He had been engaged in sanitary matters for more than 30 years, and had visited various sewage works, and a considerable time ago formed his own opinion, which was confirmed by the steps the Thames Valley Board had taken, that the only way of dealing successfully with it was by chemical treatment. The three points obtained by the Aylesbury Company were an innocuous process, a pure effluent, and the disposition of the process. Those were the three important points to be ascertained in all sewage works. At the time of the first outbreak of cholera all the learned men and medical authorities cried out there was death in the cesspool, and legislation followed, compelling all the towns within ten or fifteen miles of London to close up their cesspools, and they were all compelled to carry out a system of drainage conveying the sewage into the Thames. This was done under the heavy penalty that if the local authority did not carry out the works, the central authority had power to come and do it for them at an enormous cost. That was done at Kingston-on-Thames at very great cost, and so matters went on, all the towns pouring their sewage into the Thames, until the next outbreak came, and then it was said that death was in the rivers, and then came legislation to compel those towns to remove from the river the sewage which they had been compelled to pour into it, and they had ever since been trying in the most thorough *bona fides*, had spent considerable sums of money, and on two or three occasions had bought the land to endeavour to get rid of the sewage. Finally they had a vast inquiry, which lasted over five days, into the question of the Thames valley sewage, and cost 20,000*l.* or 30,000*l.* This inquiry ended in nothing. It simply condemned the systems then proposed of dealing with the sewage of the Thames Valley by ordinary irrigation. He was glad to say that that very Board of twenty-four members had now unanimously determined that the only way of dealing with it was by chemical treatment, and at this moment two eminent engineers were appointed for preparing a scheme or schemes for dealing, on this plan, with the sewage in one or more places in the Thames valley, and this was the nearest approach he had yet seen to a solution of the difficulty. The delay which had taken place was not due to the local authorities, but to the Local Government Board, to whom was entrusted the supervision of these works. Their idea was total diversion, and they had sought to force that upon the local authorities against their convictions, endeavouring to compel them to carry away the sewage by what was called the West Kent sewer, and throw it into the Thames. The only effect would be to involve hereafter an additional cost in carrying farther the same defective appliances. They did not want additional legislation, for the local authorities were perfectly ready to do what they could. They had spent money in a liberal way in endeavouring to solve the difficulty, and he did hope they would now get a solution in the direction he had named. He was quite certain that the Aylesbury Company had done more at Coventry to demonstrate the evil of this method of dealing with the sewage than anyone else ; and although there seemed to be a prejudice against these works, he believed that every month that prejudice was passing away, and that this method or some similar one would be adopted in the Thames valley. On one occasion he went with a deputation to the Local Government Board, saying they were prepared to carry out works to the satisfaction of the Board, and complete them within one year from the date for adopting this process, but the scheme was refused. It was a singular thing that out of the many towns on the Thames valley to which reference had been made, and which had propounded schemes and submitted them to the Board, all had been rejected but one. The only scheme which the Board consented to was that for Richmond, and when the local authorities attempted to carry it out it was found absolutely impracticable.

Mr. C. H. CRESSWELL had great pleasure in supporting the resolution. He believed it to be an eminently practicable one, and entirely agreed with the decisions arrived at by the Public Health Conference held by the Society of Arts two or three years ago. The great evil which existed at the present time was the apathy on all sides, both of the Government and the people. It was not necessary there to discuss the question, whether rivers ought to be polluted or not, or whether people had any right to pollute them, though the question had been asked, and before sitting down he would take the liberty of answering it. Nor was it necessary to discuss the propositions whether fish could live in polluted water, or whether fish was of any consequence to the food of the people, or whether river water was rendered unwholesome for human purposes by contamination. Those were all matters which were admitted in every civilised society. If they were to go to Yorkshire, and walk along the banks of some of those famous streams, or by the Clyde or the one to which Mr. Milne Home referred, it would be quite easy to discuss the point whether fish could live in them—some were black, some were red, and some were blue, and he believed some were green; it entirely depended on the particular dye which happened to be in vogue at the time, and the emphatic answer which was once given to him by an old woman was conclusive whether the pollution was injurious or not. He asked her whether she could use the water in the river for the ordinary purposes of washing, and she said she only used it when she wanted to dye her clothes. In that sense no doubt the rivers were valuable, but they were not intended for any such purpose. What was wanted in order to cope with this great evil was the support of public opinion; they had plenty of legislation, and the resolution emphatically expressed the invariable opinion of all scientific men who had brought their minds to bear on this subject during the last 30 years. There was already an Act which rendered the contamination of rivers penal, but some independent authority was required, not the criminal himself, as was too often the case, to enforce the Act which already existed, and at the back of that a thoroughly earnest Government determined to enforce the law. The difficulty was just this, the reverend gentleman asked whether there was any right to pollute rivers. Up to the year 1876 there was such a right. He had told them that in certain districts in the neighbourhood of London not only had they a right, but they were actually compelled to pollute them. It was considered the rivers were given by God for the express purpose of carrying away down to the sea the filth and refuse of the human race, where it could be swallowed up and annihilated. In certain rivers in England the manufacturing population had for centuries claimed the exclusive right to pollute the rivers, and if a miller or a dyer, or fuller, or any other manufacturer were charged with the offence of polluting the stream to the prejudice of his unfortunate neighbours, the answer always was that they enjoyed the special privilege for twenty years, and therefore had a prescriptive right to foul the river and could not be interfered with. He recollected a celebrated man, who afterwards became a member of Parliament for a Borough in Yorkshire, who was charged by the Royal Commissioners twenty-five years ago with contributing more largely than anyone else to the pollution of the stream which flowed through the town of which he was a distinguished member. He said he was quite willing to do everything he could to put a stop to the pollution, but he and his firm had enjoyed the privilege for sixty years, and he was not going to give way. When men argued in that way the great want was more healthy public opinion in order to get over that which was the most deadening and difficult of all obstacles, namely, apathy combined with ignorance. These prescriptive rights which were exercised all over the country, and especially on the Irwell, brought about pestilence which was commonly considered an evil; but, in his opinion, pestilence, which came down from Heaven at various times, had been the greatest Divine benefit which could ever have been conferred on the people. The cholera did more good to England than anything which ever happened, for they all knew that it was after the cholera outbreak in 1847 and 1848 that there were passed in this country the first measures for the public health, which had gone on steadily improving and increasing since. The prescriptive pollution had risen to such a pitch that no water could be had for any purpose whatever, and then what was called the Rivers Pollution Act, 1866, was passed, and effectually put a stop to all the nuisance about prescriptive pollution, and, for the first time in the history of the country, made it a misdemeanour to pollute a river either at the source or any part of the stream where it passed through a populous district, wherever there were any riparian proprietors prepared to enforce the law. The mischief of the Act was that there was no one to put it in force· It was a beautiful piece of logic, but in many cases where an attempt had been made to enforce it they found their hands were tied, and they were perfectly powerless. It was rather a prolix question to explain, but he would endeavour to do so shortly. In the first place the persons charged with the enforcement of the Act were generally the greatest offenders against it, viz., the local authorities. If you went to the local authorities and asked them to stop a particular firm polluting the stream they would say : Yes, we will do what you want, but inasmuch as the local authority was polluting the stream with sewage, they were naturally nervous about commencing proceedings, and thought it better not to stir up muddy water, and so in the end nothing was done. Then the Act gave power to an individual to go under those circumstances to the Local Government Board and ask them to assist. That had been tried, but there was so much red tape and circumlocution that the libraries and registries of the office were papered with documents, in which they threatened, exhorted, encouraged, and so on, but it really ended in nothing. He believed there was only one city in England where any attempt was made to put the Act in force, and there it failed because the local authority would not take the steps. Perhaps the Local Government Board did not think it worth while to offend the town, and the end was that nothing whatever was done, and the unfortunate riparian proprietors whose fish were killed for miles below Hereford, were told by the local lawyers that they must put the Rivers Pollution Act in force themselves; they accordingly filed a plaint in the County Court against the town, and the result was, the town was convicted and a serious penalty imposed. Mercy intervened, as it always did, and an opportunity of repentance was given to the city, which was allowed a certain time during which it might kill all the fish in the river, and at the same time take the measures it ought to have taken 10 years ago. Perhaps in 6 months' time a renewed action would take place. That was a case within his own knowledge in 20 or 30 important cities in England. He believed the reading of this paper and this resolution as the unanimous expression of opinion of such a meeting would do something towards the formation of a wholesome public opinion, and unless public opinion was as wholesome as the water ought to be, nothing valuable would ever be effected. If any epidemic were to break out the public would move in greater alacrity, and he had been much struck with the conclusion of his friend's paper in which he alluded to a little black cloud on the horizon and gave an emphatic warning to the public. He saw by the evening paper, that the cholera, instead of diminishing, was spreading rapidly in the East, so as to give occasion for the greatest misgivings. It seemed a terrible thing to look forward with any degree of pleasure to such a calamity, but still he thought it was quite right to use an expression which had become proverbial, and was often supposed to be Scriptural, thought it was not, viz.: that God tempered the wind to the shorn lamb, and if they did have an epidemic he was perfectly certain that would be a magnificent demonstration of the grand doctrine that all things worked together for good, and that good would come out of evil.

(The resolution was then put from the chair, and carried unanimously.)

Mr. SYKES moved a vote of thanks to the Hon. Mr. Mainwaring for his paper.

The Rev. J. MCALISTER seconded it, and asked leave to include in it a vote of thanks to the Chairman.

The resolution having been carried unanimously,

The Hon. Mr. MAINWARING said he was extremely gratified at the result which his paper had produced, especially as it had elicited such a practical discussion, which he had little dreamed of. Everyone seemed to agree in the views he had expressed, and he hoped that now the public would not go to sleep and sit twisting their thumbs, which was very much the fault of Englishmen; they were too apt to say what a dreadful thing it was, but they did not do anything unless some body of energetic men took action. He found everywhere that it was by a small amount of leaven that the whole lump was put in agitation. He hoped the paper and discussion would have some practical outcome, and would have a far greater effect through the medium of the press. The press was all powerful in these matters, and he wished it would put before the public more fully the condition in which we were at this moment in regard to river pollution. If the press would move, the public would follow, and if they would only take the matter up, the desired end would be attained much quicker than otherwise could be hoped for.

The CHAIRMAN also briefly responded to the resolution, saying how pleased he was at the result of the meeting; and the Conference then adjourned.

THE

FISHERIES OF IRELAND

BY

J. C. BLOOMFIELD.

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CONFERENCE ON 30TH JULY, 1883.

THE EARL OF MILLTOWN in the Chair.

IRISH FISHERIES AS AN ENGLISH SUPPLY.

THIS great gathering of fishermen and fish consumers of all nations will be more or less taken advantage of by every civilised community to gauge the opportunities and shortcomings in the development of God's greatest gift of sustenance to man—a harvest to be gathered without sowing, and, under infinitesimal restrictions, to be annually used to *the utmost capacity of natural appetite without fear of annihilation.*

To add my mite of information on the subject from Ireland's point of view is now my task.

The words of H.R.H. the Duke of Edinburgh at the earliest meeting of the promoters, where he specially alluded to the results which he apprehended would flow from their labours in the stimulation of Irish fishing, are conclusive on the side of what he expected they would be able to do for the coast population in that country; but this is indeed only a small and local element in the consideration of the subject, the main expostulation including much more serious and Imperial interests.

I have had in preparing this paper to consider closely the Report of the Inspectors of Irish Fisheries, and I must say a more disheartening job I have never undertaken, although they have made the most they could of a weak case, and put as good a colouring as possible to make the pale face bear the light before a national audience. It would take me long to do it justice, but I will give you an idea of what the country is losing.

In page 4—"Herring Fisheries," 1882—statistics have been taken from the following places *only*:—Howth, Arklow, Kinsale, Greenore, Ardglass, Omeath, and Warrenpoint, Kilkeel, Amalong, Courtown and Balbriggan, from which points were captured 70,457 mease, at a total value of £78,860.

Of course you will imagine that these are scattered denominations, representing the attacks upon the herring, *all round* the coast of Ireland. *No such thing;* look at the map behind me, where I have marked them *all.*

But, to make things worse, when I refer to the report of 1879, I find that *these same points* are *there* declared to be *then*, as NOW, the ONLY places from which regular and authentic returns *can* be procured! *Worse again*—I *there find* that the value taken in '79, from these *exceptionally favoured* places, which make up the Irish contribution to English supply is considerably over that of 1882. Well, but what proportion of our coast do these places represent to calculate this? We must turn to the divisions, and *there* I find that, giving the *whole possible area* in which these fishings could be defined, the mileage amounts on the east coast to 223 miles, and Kinsale to 110 miles, making altogether 333 miles, leaving besides four divisions—the length of which is not given in the report—2337 *miles of coast with no return.* With these Government statistics available must we not charitably imagine that the Treasury cannot have read them, when opposing Mr. Blake in a pitiful *grant of our own money* towards carrying out the recommendations of the

Inspectors, in developing such an accessory to employment and contentment in Ireland as well as additional national supply? Perhaps our good friend Professor Brown Goode will tell us what 2337 miles of coast teeming with fish would mean, in a value sense, to the people who breed shad and raise carp remuneratively in mud baths. I have no time even to hint at the aggregate amount of loss when we add mackerel, cod, and all the edible fish, besides herring, in the length of coast stated. I will but touch on the mackerel, as I have little time to emphasise what we have learned in the herring report. In the captures at all the stations, amounting to 199,779 boxes, £128,473 value, the *little* fishery pier of Baltimore springs into a prosperous station in a remarkable manner, rising *in two years* from 9845 boxes to 56,643, making, with the established fishing harbour of Kinsale, the amount of 177,000 out of an Irish total of 199,779, leaving but 22,779 boxes for all the rest of Ireland—close on 3000 miles! The fish were there when the 9000 boxes represented the whole take in 1880.

How is this? Simply a pier was built, costing £4000, by Government, and the people (who could not fish before, and so had no money to start) found a patron, who advanced the necessary funds, and see the result. The Report also shows that turbot, soles, mackerel, cod, haddock, herring, whiting, sprats, lobsters, crabs and divers coarse fish abound in every division; and it will be remembered that the old theory hitherto commonly obtaining, that the shoals of herring and mackerel passed along the whole coast, has been rudely shattered at these Conferences, *so* that the utilization of new fishing ground does not only give an extra catch to the human congener of the herring-loving cod, but, encountering a new supply, is like the discovery of an *original source* of *national wealth* and *sustenance;* and however science may be required in England to overhaul the experience of the United States in propagating sea-fish —and I heartily hope science will insist upon its legitimate rights in this respect—neither science nor law founded upon it are wanting to give the country knowledge, *if* it feels that it wants fish, and as a natural sequence that it should be had *if possible.*

The means for carrying on the industry of course is confined in extent to a scale consistent with the demand which has hitherto been purely local on the coast-line in question, and the reason sufficiently explained in the above Reports, namely, an absence of means of transit, and in many places a want of safety piers and small refuge harbours for boats. Let me shortly quote again a passage or two from this important official document :—

"INSPECTORS OF IRISH FISHERIES.—The importance of securing facilities for transport to the great markets cannot be over-rated—they exercise the greatest influence upon the fisheries of any locality—as a rule securing to the fishermen more satisfactory prices for their fish, and bringing them in direct communication with the large buyers.

"The coastguard officer considers the fishing in the locality to be excellent, but thoroughly undeveloped. The drawback to the fishery is the great want of the means of transit or want of curing stations, but that energetic fishermen, not fishing spasmodically, would make a good profit. The shoals of fish off the coast, particularly herrings and mackerel, are sometimes enormous, from which local fishermen get little profit.

"The great drawback to any fishing being prosecuted on an extended scale in this or any other similar locality is the great distance between the place of capture and a line of railway ; at present, the nearest station is Tralee, situate twenty-seven miles from Dingle, and about thirty-five from the fishing-ground.

"We cannot over-rate the importance of providing safe and convenient harbours wherever practicable, as without proper shelter for the boats it is not to be expected that there can be any great development of the fisheries."

Besides the above, in the Appendix to this paper will be found the denomination of 70 points on the coast where the Inspectors have unanimously recommended fishery piers to be constructed. To Lord Waterford's opinion, that "there was as great wealth in the seas of Ireland as in the seas that washed this country," I can add the testimony of the Minister, Mr. Shaw-Lefevre, who admitted this but hazarded the officially informed addenda, that the elements were against our securing the prize, though he did not explain how the law of storms, coeval with Cabinet sympathy, kept an eccentric puff in hand for my poor country, whilst refraining from interfering with the Norsemen of Shetland or the fishermen of Newfoundland.

I will not weary my audience by going over the ground so exhaustively trod in these Conferences by such men as Huxley, Brown Goode, and others, fully proving to the fair mind the inexhaustible supply the seas afford. It is enough for me that all authorities unite in proclaiming that the Irish coasts are not exceptional as resorts for the vast shoals we have heard so much about in recent interesting papers; but ere I leave the consideration of our coast fisheries, I would earnestly ask my audience to make a special inspection of the United States annex, with a view to appreciate thoroughly the question, and not to forget to pause before the jars which hold the produce of such refuse of the cod as its head and backbone turned into a valuable agricultural recuperative, while the edible portion is preserved for human food; and, above all things, to study the grandest specimen of piscatorial topography ever exhibited, in the official fishery map of the United States, which I hope will not leave this country until it has stamped its merits indelibly upon our department.

I now come to the consideration of the most practical matter, not only connected with the subject of this paper, but with the outcome of this great international exchange of experience and ideas on fish supply, viz., the possible result of the utilization of our inland waters, of course confining my statistics to Ireland, while generalizing the knowledge I have acquired in this building on the point.

My *début* in connection with these Conferences took place at the reading of a paper on coarse fish by Mr. Marston, which, however, was principally confined to the production in artificial waters. The discussion on that paper, however, led me to put to myself the query—how many thousand acres of small lakes exist in Ireland, all more or less containing fish bad and good, though mostly the former, which, now contributing nothing to the food supply of this great country, could with small expenditure be made to add a defined annual tonnage to the present amount of a most wholesome, economical, and appetizing nutriment for the poor? No sooner struck with the importance of the demonstration than I hastened to acquire statistical information. I knew that by an application to the Ordnance Survey Department in Phœnix Park the exact return of the area of each lake in Ireland could be supplied me from the six-inch map, and so the application was made, but time would not allow for the calculation, so I was obliged to fall back upon that wondrous compilation, Thom's Directory, and there I found the area of inland waters in each county given, and for my purposes at present will answer so far as to force the consideration of this important matter not only upon the Government and leaders of opinion in Ireland, but likewise upon the minds of those in this country who, for private gain or sympathy with the poor, would like to see utilized all practical means for providing their sustenance.

The inland waters of the 32 counties as given in this most truthful publication amount to 574,887 acres, and the production from them is chiefly confined to the comparatively few tons of salmon and eels which are supplied from the large lakes into or from which rivers run, and both these fish are restricted from price to the class of luxury. My next move, after contemplating my figures, was to discover from the resources of the Exhibition whether indeed such a treasure of industrial and food resource did lie at our command under the smooth waters of our inland lakes hitherto unutilized. England could find me no information except in a book on ponds, by Marshall, some 120 years ago, though I believe, if my classics had not been like the neglected waters, Cæsar would have informed me that the Romans provided for their certain supply by ponds in Britain. Ireland too has sundry local names which prove that our ancestors there—those who, like myself, have a portion of the blood of the breechless Bryan Boroohne—secured to the religious houses the necessary piscatorial supply; but what I could not obtain from the old country herself, her reliant and provident children of the West voluntarily and kindly afforded; and it is to the extraordinary—in the broadest sense of the word—knowledge and experience of my friend, the United States Commissioner, that I am indebted for the following facts.

In the United States the cultivation of fish is not left solely to private enterprise, but is encouraged, and materially assisted, by the State, the reports of the Government officers being exhaustive returns of their own work and quotations from all the authorities of Europe; appropriations to the amount of 1,000,000 dollars having been already granted by Congress to develop this great source of natural food. Apart from the culture of their own fine normal species they have imported carp in large quantities from Germany. Hear the Fish Minister (as I call him) on this subject:—"The most noted features for the year ('79) are, first, the commencement of the distribution of young carp to various points in the United States; and, secondly, the authorisation by Congress of a special steam vessel to serve as a floating station for the hatching of shad and other useful food fishes." Further on, speaking on the general cultivation of fish, "This is carried to perfection as far as the carp is concerned, for not only are its eggs hatched artificially, but it is *nursed* and *tended* like a *domestic animal*, and even to prosiness." I must add, in the interest of our thousands of natural waters, the quotation, "That it will be of great advantage to permanently stock our lakes and rivers with young carp, as carp raised in lakes and rivers have a much finer flavour than pond carp. The only way to raise those large and beautiful carp, weighing 20 to 50 pounds, the beau ideal of carp, the proprietors of lakes, and even those renting lakes, should stock their waters with large masses of young carp."

From the same source I learn that "France before the war had carried out, on a large scale, the system of artificial impregnation, and have thereby exercised a very beneficial influence on fish culture throughout the whole country. The smallest areas are cultivated, and the best possible use is made of the different characters of the waters. France has more than 4600 miles of lakes and ponds. French statisticians compute the annual gain from the *freshwater* fisheries at four million francs ($800,000), and the annual rent of every hectare of water at $15 (or 30*s.* per acre). The fisheries, however, are not yet able to supply the home demand." "By the cultivation of fish in France, at first in the rivers in the localities where there was the greatest amount of poverty, a new life has been developed, so that many a poor fisher and farmer has become a man of means through his little fish-pond." The Marquis de Jolleville in Normandy, from one stream and fish-pond, made $750 to $900, that ten years since did not produce one."

Coming to Austria, the United States Commission quotes "Carl Peyrer," that from 370,500 to 492,000 pounds of carp are sent annually to Vienna from the estate of *Willuyn alone* in the south of Bohemia; the *acre* of *water* in Austria is valued at $9 (or 36*s.*). The same authority writes: "*Civilized nations cannot do without this important aliment without detriment to themselves. Fish even without an elaborate dressing forms a good and easily prepared meal for the labouring classes; their flesh contains* as large a quantity of proteine as pork. 100 lbs. (Austrian) of fish flesh contains as much nourishing matter as 200 lbs. of wheat-bread, or 700 lbs. of potatoes";—prodigious fact, which brings me back to a consideration of the primitive denizen of a farm in Galway or Donegal striving to eke out a miserable existence on the watery tuber to which his primitive knowledge and situation holds him, while close to the doors, with the full moonlight reflecting his own shadowy life on its neglected waters, lies the lake which might hold, with half the labour of his potato plot, 15 *times* the *nutriment* (considering the deterioration from disease) *in a given weight.* 574,887 acres of water to be utilized at a trifling expense to produce what ?—I dare hardly write the sum, nor has it yet scarcely passed the portals of my appreciation, so wondrous is its meaning, so marvellous the effects to be produced. But here is the book from which I have compiled my area statistics, and in the United States annexe is to be found the man who, by his own and country's experience and world-wide investigation, must be answerable for my conclusion that there is idle in Ireland a portion of its surface capable of yielding, at the French computation, £862,330 annually, and supplying innumerable tons of food to the Imperial store. Let any member of the Legislature move for a return of the inland waters of Ireland, and their several acreages which I have shown can be readily given, and their deducting such areas as the Lakes Erne and Neagh, and confining the calculation to lakes and waters completely within our own power, to utilize *to the full*, and there remains a wondrous lever to raise the status of the people there, and by a mutual interest increase the correspondence and further the intimacy and confidence of the two countries. For evidence, however, on the vital abstract of unlimited demand, I must come to England for my information, and London alone will pretty well suffice to set the matter at rest. I find Mr. Birkbeck, M.P., while presiding at the Inaugurating Meeting of the "Fish Culture Association," said he hoped that "the Government will see its way to affording support similar to that which was afforded by the Governments of America and Canada ;" and further stated that, "owing to the demand for fish as food, it was necessary that something should be done in the direction of fish culture in rivers as well as the sea." That *this* is an authoritative piece of evidence that the present supply is *not sufficient* an audience in this building will not deny. I might quote speeches without end, supplementing this acknowledgment of the want of more fish in London, not only in the description which forms a delicacy at the rich man's table, but for the coarser sort, which Mr. Osborne, of Clerkenwell, so truly states were "essential for the sustenance and physical well-being of the poor people." My audience will, I am sure, again appreciate my abstention from overloading this paper with oft-repeated truisms, which are patent to the readers of every public journal, especially as I have personally gauged the soundness of the conclusions by the unerring standard of value. I have purchased cod in Mr. Whiteley's stores at 1*s.* per pound, and have seen it labelled elsewhere at 1*s.* 4*d.* In King Street, Hammersmith (a remarkable place on a Saturday night), I have bought, and subsequently eaten with satisfaction, five sprats, *beautifully cured*, form and colour preserved, for 1½*d.*, tied in a bundle. I have purchased mackerel at 9*d.* each, and refused them at 1*s.* But let us probe the matter further, and see whether in the circumstances attending the transfer of fresh fish, under the present available supply, from the place of capture to the London market accounts for the present price.

In a circular I produced at the Conference on the reading of His Excellency Mr. Walpole's paper, the rates of fish from the places of capture to the several towns in England did and do show a want of appreciation of the great trading motto of low price and large and quick turn overs; but to show you what a blessing railway connection is, even with exorbitant rates, the settlement of that great corporation on our eastern coast at Greenore, with the best plant, as I am constrained to say, metamorphosed the district into which it has penetrated, by running over the Great Northern system right across Ireland, taking salmon, eels, and other fish as far as from Ballyshannon on the west—a return which I have here from one village *en route*, giving of eels alone 28 tons, from January to June, which at 8*d.* per pound average—I have known 10*d.* to be paid—comes to over £2000, going to a village of 400 inhabitants, all conveyed to London by the "London and North Western Co." the responsibility never leaving the same carriers from Ballyshannon to the place of consumption; no, though we pay for our whistle more than we should, and though we might be defeated in a battle of rates with the most influential public carrier in the world, or be cast in an appeal to their generosity in favour of the London poor, or Irish starvelings, I am certain that the rates swelled even in their immorality by the addition of a Billingsgate ring, that we hear of often, would not account for the high price of fish, or show that the present supply was sufficient for the existing population of Great Britain, to say nothing of the vast annual increase. Then to secure to the people of this country the mine of national wealth ready to hand in Ireland, requires but the means of transit, boat refuges and enterprise; and in most countries the first and pressing necessity would be solely effected by the Government, where the object to be obtained was the supply of a physical want to millions of people daily. But in England the jealousy of State meddling (so called) has reached such a pass, that although special interference with the laws of political economy daily obtain on the grounds of abstract justice, the inhabitants of Lambeth might starve in the midst of plenty, and the Irish poor rates in the coast unions rise to 10*s.* in the pound, before a helping hand would be given on the part of the State, unless the royal princes and their influential and philanthropic congeners, who promoted this Exhibition, determine on coming to the rescue. Two methods of dealing with the raw material of this great Imperial source of sustenance are required to ensure the greatest possible use of this wondrous gift of the Great Provider: first, the transport of as much as possible to England in its natural state; and, secondly, to provide curing stations on the coast. These methods should receive equal attention. Herring and sprats visit the coasts in amazing quantities, and while swimming undisturbed on the shores of Donegal, whole parishes within 10 or 15 miles inland have been on the verge of famine, and while fresh fish in London, Manchester, Birmingham, and all the towns mentioned in the accompanying schedule will ever be above the opportunity of the pauper class, well-cured skate, halibut, herring, and sprats, conveyed by special parliamentary rates, should ever be available for a family with the lowest coin of the realm at their disposal.

WHAT IS REQUIRED AND WHO SHOULD DO IT?

In the first place, as has been shown, railways. Where *these are* present with the fish, all is serene, but the conveyance must be the shortest possible route, in point of time, that science can suggest and carry out. A gap of a few miles cuts off the supply; fast steamers may come down the coast of England in less time than the locomotive, and the same method may be adopted to carry the fish to a western port in England, connected with either of the great railway systems from any part of the east coast of Ireland; but the products of the western coasts of that country, specially the north-west, must come across the island. Here some would say, "Do you want the Government to take upon themselves all the work connected with the development of the Irish Fisheries?" Certainly not; I wish to see *Imperial interference reduced to the minimum of necessity*, and that point in relation to this question I proceed to enunciate. Recent legislation (whether wrong or right is not the question here) has operated to extinguish individual exertion towards promoting local railways; and as the development of the fisheries combines a two-fold imperial benefit in the interests of the producer and consumer, it is the duty of the Government to go so far in assistance on this head as to bring the construction of fish-bearing lines under the influence of practical enterprise, by advancing money at a low rate of interest, up to such an amount as they may be advised the undertaking will secure, and advances should be freely made, where the inspectors deem it absolutely necessary, *to construct small piers and harbours for the safety* of the boats. Then, again, it is the absolute duty of our Government to take the initiative in popularising and promoting the question of the development of the Irish inland fisheries by following the example of the United States in initiating the acclimatisation of fish and their artificial propagation; and I would here allay all dread of extravagant State outlay by stating, on the authority of Mr. Earll, that his Department collected and hatched 500,000,000 white fish at one station for £300. He also informs me that he is quite sure the expense of breeding carp for distribution throughout Ireland would not exceed a few hundred pounds. Two sets of ponds of less than 3 acres in area sufficed to plant carp in 17,860 localities in less than 3 years. It must be borne in mind that the aim should be the providing a poor man's fish, altogether ignoring the question of sport. This has been considered their duty by the American authorities; and, as Mr. Earll tells me, the result of the introduction of carp has been "that a small mill-pond suffices to keep a family going, in which they are commonly fed like pigs, entirely on Indian meal or partially with planted weeds."

On the serious question of adaptation to climate Mr. Earll's experience leads him to believe that although the carp may not arrive at maturity as soon, or grow to the immense size in Ireland which they have arrived at already in the Southern States, from the statistics of the temperature the fish is that which should be adopted for our small lakes and ponds, natural or artificial, essentially to be so planted for the benefit of those who can command ever so small an area of the liquid element. I have been irritated by the remarks of rotund friends on the coarseness of this fish—ridiculous as proceeding from men who revel in "congor" under the name of "turtle," and libellous on the populations of a vast portion of the Continent of Europe for generations, as well as casting a slur on the palates of our western cousins. But in truth certain fishes are fashions in various countries. The eel in Scotland (says his Grace of Argyll) is avoided as if it were a descendant of Eve's tempter; and in the Southern States (records a Yankee friend) a man who eats eels is tabooed, and to present one dressed in any detectable guise to a guest hazards a pill served in a "Derringer" as a digester for the host. Every fish (as the able Japanese who took part in the Conference stated) has its sauce, and I have yet to believe that the poor, half-famished family—working, mayhap, till dawn in the struggle for existence and liberty outside the workhouse, preferred to satiety within—would turn aside from any wholesome and nourishing diet to which they would bring the relishing dressing of hunger. Shad for our rivers and white fish for our large lakes would, as far as the experience of the American Department goes, suffice to bring up the Irish waters to the standard of production at which we should aim ; and where shall we roam to find the materials for an appeal from this decision ? At p. 55 in Professor Brown Goode's able paper we find, "Pure and applied science have laboured together always in the service of the Fish Commission, their representatives working side by side in the same laboratories ; indeed, much of the best work both in the investigation of the fisheries and in the artificial culture of fishes has been performed by men eminent as zoologists ;" and further, with reference particularly to the inland fisheries, at p. 67, "The planting of shad in California and the Mississippi Valley, and German carp in 10,000 separate bodies of water in almost every State in the Union, carried out within three years, is a success beyond a doubt, and of the greatest importance to the country. It has been demonstrated beyond possibility of challenge that our great river fisheries, producing in 1880 48,000,000 pounds of alewives, 18,000,000 pounds of shad, 52,000,000 pounds of salmon, besides bass, sturgeon, and smelt, and worth at first hands between 4,000,000 and 6,000,000 dollars, are entirely under the control of the fish culturist to sustain or to destroy and capable of immense extension." I have dwelt upon the American pioneering because I believe we want no other beacon to guide us in starting to work on the development of our Irish fisheries ; and am I not warranted when the following are the words uttered by no less an authority than Professor Huxley ?—"that any nation at the present time had comprehended the question of dealing with fish in so thorough, excellent and scientific a spirit as that of the United States." Have

I not stated enough to induce those in authority, and having the power to take up this matter in the interests of a country containing such an incalculable number of independent waters, now lying waste from neglect? and I would feign have the reply of King James to the emigrating Puritans of New England, who gave "fishing" as one of their inducements; "So God have my soul, 'tis an honest trade, 'twas the Apostles' own calling." It is indeed a grave consideration when we find that from a minimum of Government patronage, the census of 1870 gives 11,000,000 as the value of the American fisheries, while at the present time, Professor Goode puts it at about 100,000,000! All beyond this moderate assistance would be provided by private enterprise educated up to the knowledge of the existing and general want of supply through the teaching of the Conferences of the Great International Fisheries Exhibition. There *is* another aid (and God forbid that, while urging the case upon the ground of duty and self-interest as between the Government and people I should be thought to condemn the exercise of spontaneous philanthropy), and, though I make no appeal to charity, no one pretending to exhaust the subject of the Irish Fisheries can abstain from noting and recording the divinely impelled experiment of a right noble lady in affording assistance to a hardy and honest class on strict principles of prudence, because the result has proved as honourable to the kindness and sagacity of the giver as it has to the character of the recipients; and during these Conferences, in a less formal manner, I stated, on the authority of the banker of Skibbereen, then present, that the result of this industry, succoured by benevolence, had been illustrated by fish purchases requiring on one day £7500. I have already shown from official returns that the fortunate place selected for the experiment has afforded more than a third of the entire mackerel supply from Ireland.

Before I conclude I would, on the part of my countrymen, thank the Royal Princes and Executive of this Exhibition for their sympathy, and wish to stamp their influence upon the pleadings for the development of this great industry in Ireland, not from any selfish feeling, but solely from the desire at least not to add to the catalogue of Irish complaints, that of neglect on their part. For myself I believe in the inspiration of all good from above, and therefore, in the promotion of this Exhibition by our Princes and their kindly utterances, with the hearty reciprocation of all concerned, seem to me to be earnests of an all-wise intention to illustrate practically that in close connection with this Empire (great only while indivisible) the true happiness and prosperity of my countrymen must ever depend.

PIERS AND HARBOURS.

The following is a list of applications received for grants-in-aid of constructing either Piers or Boat Slips, or for the Improvement of Harbours on which we have reported, and which we have recommended for grants under the "Piers and Harbours Acts," but for which no grants have as yet been made:—

No.	County.	Name of Place.	Situation.
1	Cork . . .	Ballycotton . . .	Ballycotton Bay.
2	" . . .	Knockadoon . .	Youghal Bay.
3	" . . .	Sherkin Island . .	Baltimore Bay.
4	" . . .	Robert's Cove . .	S. Coast, near Cork.
5	" . . .	Gortnakilla . . .	Dunmanus Bay.
6	" . . .	Rooska	Do.
7	" . . .	Coosagour . . .	Do.

No.	County.	Name of Place.	Situation.
8	Cork	Canty's Cove	Dunmanus Bay.
9	„	Dunlough, Coosaisland	Mizen Head.
10	„	Long Island—Skull	Long Island Bay.
11	Clare	Carrigaholt	River Shannon.
12	„	Rinnavilla	Do.
13	„	Liscannor	Liscannor Bay.
14	„	Labasheeda	River Shannon.
15	„	Scattery Island	Do.
16	„	Muckinish	Near Ballyvaughan.
17	„	New Quay	Aughinish Bay.
18	„	Seafield	W. Coast, near Miltownmalbay.
19	„	Kilkee	Moore Bay.
20	Donegal	Port Salon	Lough Swilly.
21	„	Ballyederlane	Inver Bay.
22	„	Port Ochre	Donegal Bay.
23	„	Inver	Inver Bay.
24	„	Culdaff	Culdaff Bay.
25	„	Malin Head	N. Coast.
26	„	Donegal	Donegal Bay.
27	„	Bundoran	Do.
28	„	Newbridge	Lough Swilly.
29	„	Greencastle	Lough Foyle.
30	„	Dungloe	Near Dungloe.
31	„	Kelly's Rock	Donegal Bay.
32	„	Portnacross	Do.
33	„	Malinmore	North Coast.
34	„	Moville	Lough Foyle.
35	Down	Annalong	East Coast.
36	„	Kilkeel	Do.
37	Galway	Ballyloughane	Galway Bay.
38	„	Corra	Mid Arran Island.
39	„	Cleggan	Cleggan Bay.
40	„	Callowfeenish	Kilkerrin Bay.
41	„	Carrowmore or Balli	Off Galway Bay.
42	„	Derryinver	Ballynakill Bay.
43	„	Ballyhees	S. Arran Island.
44	„	Scrahallia	Cloonile Bay.
45	„	Tarrea	Kinvarra Bay.
46	Kerry	Annascaul	Dingle Bay.
47	„	Ballydavid	Smerwick Harbour.
48	„	Ballyheigue	Ballyheigue Bay.
49	„	Coolnalahy	Dingle Bay.
50	„	Dingle	Dingle.
51	„	Portmagee	Near Valencia.
52	Londonderry	Portstewart	North Coast.
53	Louth	Blackrock	Dundalk.
54	„	Clogher Head	East Coast.
55	Mayo	Belderrig	West Coast.
56	„	Bellmullet	Broadhaven.
57	„	Carrowmore	Louisburgh.

No.	County.	Name of Place.	Situation.
58	Mayo . .	Carrowkeeran . .	Clew Bay.
59	" . .	Inniskea	South Island.
60	" . .	Killala	Killala Bay.
61	Sligo . . .	Aughriss	Sligo Bay.
62	" . . .	Pullocheeney . .	Killala Bay.
63	Waterford .	Ardmore . . .	Ardmore Bay.
64	" .	Boat Harbour . .	South Coast, near Annestown.
65	" .	Balinagaul . . .	Dungarvan Harbour.
66	" .	Cheekpoint . . .	Waterford Harbour.
67	" .	Hacket's Dock . .	Passage.
68	Wexford . .	Ballyhack . . .	Waterford Harbour.
69	" . .	Carne or Carnsore .	S.E. Coast.
70	Wicklow . .	Bray	East Coast.
71	" . .	Greystones . . .	East Coast.

The works mentioned in this list are given in the order of counties, but not in their order of importance.

DISCUSSION.

Mr. Hornsby said from the extreme point on the east coast at Ardiglas there was a long expanse of coast line which was not fished from May until the close of the year. Mr. Walsh accounted for it by stating that the Kinsale fisheries were first promoted by a tentative effort to ascertain whether they would be worth pursuing after they had lapsed for some years. Now the west coast was in exactly the same condition. Those who fished at Kinsale were chiefly from Scotland and the Isle of Man, and they returned from there, following the direction of the fish salesmen, to other parts of the coast line, chiefly to the east coast to prosecute their fisheries there, under the direction and stimulus of the fish curers, and under the patronage of the fish salesmen. For example, the Scotch east coast fishermen, who fished on the Norway coast during the winter, came to the Kinsale and Howth fisheries for the month of April or May, and then in July they went to Peterhead, Aberdeen, and other places, as directed by the fish curers. They were retained for this purpose, a subsidy being given them, and they remained there until they had secured a certain amount of fish ; if they did so within the time contracted for they were free to fish on their own account. Afterwards they went to the southern ports, such as Lowestoft and Harwich. The fishermen on the west coast of Scotland, Campbeltown, and Loch Fyne, were accustomed to fish in the same way, but of late years those fisheries had been failing ; some of the men at Campbeltown owned thirty or forty boats, and they were prepared to try the west coast of Ireland, but who was to induce them to do so ? The fish salesmen would not attend them there until they had proved the fisheries would be successful. Therefore there seemed to be a missing link, and the question was who was to promote the general movement of fishing boats attending the west coast of Ireland ? The whole coast was peopled with hardy fishermen, who, as Mr. Brady had said, were remarkable for their honesty and hardihood ; he wished he could say as much for their persistent industry ; but these men were very teachable, and if you had Scotch boats along the west coast of Ireland for the present month up to the end of September or the middle of October they would no doubt be glad to take one or two native fishermen as pilots, who would in that way pick up a little technical education, and would be instructed in the art of following fish to a considerable distance from the coast. Last week he was talking with some men of this class off Clew Bray near Achil Point, the furthest on the west coast of Ireland. He found there the appliances they had for fishing were the native coracles. If these men could be taken on board the Scotch fishing vessels and taught, in the course of time, with a little assistance from the State, they would invest their money in hookers and larger boats. The question was, who was to instruct these men? At present they only fished with these coracles; they went out to a bank perhaps five miles off the coast, and that was the last of their enterprise. The reason these boats were generally used was that they would ride in about a foot of water, they passed readily through the surf, and could be easily taken up and carried on their backs when they got on shore. He thought Mr. Walsh's idea, if it could be carried out, of having a steam carrier for going from port to port to collect the fish would be very good, otherwise it was often thrown on shore to rot. There might be tons and tons of herrings thrown on the shore, because there were no means of sending them to market. Again, another missing link with regard to these Irish fisheries was this, if Scotch or Cornish boats were to come to the south or west coast of Ireland there might be harbours of refuge as near as possible to the fishing grounds, provided by and under the control of the Government, and, on the other hand, there must be light tramways to connect the more distant parts with the established railway termini. The charts in the British section would explain why it was from the month of May or June to the end of the year the west coast fishery was practically not prosecuted; the fish were there and were not caught, first, because the men were not there, and, secondly, because the fishing grounds were so distant from any harbours.

Mr. J. A. BLAKE, M.P., proposed a vote of thanks to the two gentlemen who had read Papers. As an Irishman he was very much interested in the fisheries, and felt much obliged to both gentlemen for the most interesting and valuable Papers they had read. No man in Ireland was more entitled to speak on industrial subjects than Mr. Bloomfield, because no one had made greater efforts in that direction than he had. It was more than a quarter of a century since he had been associated with him in an effort for the extension of railway accommodation in Ireland, and for the State to purchase the railways ; it was a great misfortune for Ireland that this was not done, and also for the State, because they would have paid very well. He was very glad indeed for the sake of the fisheries to find that Mr. Bloomfield had taken up this question, and everyone who had heard the Paper would agree with him that he had dealt with it in a very exhaustive manner. He was sorry to be obliged to say, that there were very few men occupying a high social position in Ireland who took any practical interest in this question, and, therefore, Mr. Bloomfield's Paper was all the more welcome. The Paper read by Mr. Walsh was also of a most important character. He was practically engaged in the fishery enterprise in the south of Ireland, and had shown how it could be made to pay. The interest in this subject was not confined to Ireland, it was of national importance when one considered the vast amount of fish consumed in the United States. He had taken great trouble to prepare a statement, which he would put before the House of Commons, showing the aggregate amount of fish consumed in the United States, and it amounted to the enormous quantity of 12 millions a year: that was chiefly sea fish, and was entirely independent of importations from Norway, Newfoundland, or elsewhere, in the preserved condition. Out of that total the amount captured by Englishmen was 8 millions sterling, Scotland 3 millions, and not more than half a million for Ireland, and of that a considerable portion was taken by Manx, Scotchmen, and Cornishmen; and even the French fishermen came in considerable numbers to the Kinsale coast. It seemed very strange that Ireland should contribute so little to the national larder, when it was asserted so often that there was no diminution of the quantity on the coast, and, from his experience, he believed such to be the fact. In old times the English monarchs had derived large revenues from allowing foreign nations to fish on the Irish coasts. In the time of Charles £8000 was given by the Spanish Monarch to allow a certain number of Spanish vessels to fish there, and in about 1640 the Swedish Government, in return for services rendered to England, was allowed to send a certain number also. Frenchmen and Flemings fished extensively there, and the important pilchard fishery, which Mr. Walsh had not touched upon, was carried on very extensively by the Dutch, and even now in certain parts of the county of Cork there were remains of what were called fish palaces, where the Dutch used to cure the fish. He did not wish to awaken old and bitter memories, but it was quite impossible in dealing with the fishery question, to omit the fact that down to a very recent period so far from the fisheries being encouraged by the government they were absolutely discouraged and depressed. It seemed to be the idea that the fisheries of Ireland were to be for the benefit of every one save and except the Irish themselves. The Cromwellian Parliament was inundated with petitions that the Irish fisheries might be suppressed in consequence of their competition with the English, and under a commonwealth ordinance there was an immense amount of suppression; many fishermen were sent to Connaught, and others transported to Barbados and the other West Indian islands. He would not go further into these matters, but he merely stated them for the purpose of showing that there was a strong claim on Imperial assistance now, for the purpose of forwarding the long neglected and even repressed Irish fisheries. One circumstance would prove why these fisheries ought to be helped as a matter of Imperial interest. It was an unquestionable fact that the fisheries in the North Sea were considerably diminishing, and at this moment, or very lately, there was a Royal Commissioner nominated for the purpose of inquiring into the cause of this diminution of fish in the North Sea. Under such circumstances it was most desirable that the fishing resources of Ireland should be developed to the greatest possible extent. There were only £500,000 worth captured, and that quantity might be readily augmented ten-fold. The previous speaker had alluded to the very small amount to which the west coast of Ireland was utilised for the purpose of fish capture, but there was no doubt that arose from the want of sufficient harbours. From the mouth of the Shannon to Galway Bay, about seventy miles, there was only one indifferent harbour on the coast of Clare. For thirty-five miles, from Galway to Liscanor Bay, there was no harbour which would accommodate a boat of even ten tons, and from there again to the mouth of the Shannon there was an equal absence of harbour accommodation. Fishery companies had been established for the purpose of fishing the west coast, but they had all failed, chiefly from this cause, because owing to the tempestuous character of the sea, the crews were often obliged to remain for weeks in a state of enforced idleness, and he was sorry to say that they then often resorted to the public house to kill time, so that when the water was suitable they were not in a fit state for resuming their labours. He was happy to say that, owing to a very important vote lately passed for granting out of their own money, the Church Fund, £250,000, the want was likely to be supplied, and he had no doubt as a consequence very important fishery enterprises would be established. It was quite out of the question for men to think of getting boats suitable for fishing in those tempestuous seas, if there were not adequate harbours to seek shelter in. Another important point as mentioned by Mr. Walsh was the great inconvenience and loss which in the south of Ireland a fleet was put to by being obliged to come into harbour with each cargo of fish, and there was no doubt that an immense improvement would be made if steam power were employed. That, however, must be a matter of private enterprise. All that the Government could be expected to do was to provide the means for harbours. Then he spoke of the great want of more suitable boats and gear, but there were two sources of supply now in operation. The inspectors of fisheries had a fund of £500,000, from which fishermen could borrow at very moderate interest for the purpose of supplying boats and gear. Since that fund had been in operation, the inspectors of fisheries had lent out about £50,000 to the fishermen of Ireland, and, very much to the credit of those men, the whole of that sum had been paid back with the exception of about £1,000, and even that very small sum would not now be outstanding if adequate means had been taken for its recovery. Besides that, there was a Society in Dublin which had £30,000 or £40,000 at its disposal for the same purpose. An important provision had been introduced last year, enabling the inspectors instead of lending money to advance it in the shape of boats and gear which was a great improvement, because he was afraid some of the money was often applied to very useful purposes, such as portioning their daughters, paying rent, enclosing land, and such like. Now the borrowers were debarred from that kind of thing, and instead of getting the money obtained the same assistance in kind, which would tend very much to the advancement of the fisheries. He had a very well grounded hope that there was a great future for the fisheries of Ireland. It was much to be deplored that there had been a very great decrease, owing to causes which he would not stay to enumerate in detail, but subsequently to the famine the numbers of fishermen were reduced from 113,000 to 25,000, and the boats from 20,000 to 6,000 or 7,000; still he had strong belief that with the means now placed in the hands of inspectors of fisheries a great stimulus would be given to the enterprise, and that many other industries, such as boat-building, sail-making and net-making, would be put in motion also. It was not Ireland alone which would benefit by the promotion of this industry, but the United Kingdom also would participate by having a very largely increased quantity of the most wholesome food contributed from the Irish seas.

Mr. **EARLL** seconded the vote of thanks. Those who had paid attention to the questions which had come before the Conferences must be more deeply convinced than ever of the importance of the fisheries, and of the necessity of the utmost caution in all questions of fishery legislation, for fisheries, though little understood, now rank among the principal industries of the world. They had had to-day two Papers by gentlemen evidently deeply interested in the subject. Mr. Bloomfield had spoken of the possibility of increasing the supply of fish in the inland waters of Ireland, and had referred in very flattering terms to the United States Fish Commission, and to their method of stocking inland waters. It was found in a country like the United States rather difficult to get the best quality of fresh fish sent from the sea-board for 1,500 miles into the interior, and Professor Baird, who was at the head of the U.S. Fish Commission, determined to see if he could introduce some fish that might answer as a good and substantial food for the people of the interior who were deprived of the fish of the ocean. He, therefore, sent to Germany, and secured a quantity of German carp, which he thought might be adapted to the inland waters. These were imported at the Government's expense, kept in ponds, and artificially propagated until a sufficient quantity had been raised to warrant their distribution to the smaller waters of the interior. As soon as the supply was sufficiently large, the distribution began, and year after year it had increased, until, at the close of 1882, German carp had been introduced into upwards of 18,000 different localities scattered over all portions of the United States. It was at first considered doubtful whether these fish would be suited to American waters, and it was therefore decidedly desirable for the Government to undertake the experiment of their introduction, for no private individual or company would feel justified in hazarding their funds on such an uncertain venture. He was happy to say that the efforts of Professor Baird had proved successful beyond expectation. The German carp were found to increase more in size in the waters of Florida in eighteen months than they did in their native waters in four years. Thus it was found possible to introduce valuable food-fish into the inland waters of America—and under that term he included mill ponds, and the little ponds on the lands of the farmer—for many farmers were now clearing the rubbish out of their little ponds, and were sending to the Commission to obtain a supply of carp which was given them gratuitously, and many were now raising them successfully, frequently distributing the young to their neighbours gratuitously, or selling them at a low price. He thought it would be quite possible to do the same in the inland waters of Ireland. Mr. Walsh had made many suggestions, some of which were very valuable, especially that relating to the introduction of steam into the herring fishery. Only last week he had visited the coast of Scotland with the express purpose of studying the herring fisheries of that region. He not only visited the fishing ports, but went out both upon a steam trawler, and upon a herring boat, to see the methods adopted for catching fish. At Aberdeen—the port from which he sailed—about 500 vessels started, and proceeded to sea, some 30, some 40, and some 50 miles. The fish were fairly plentiful, and a number of the boats secured good catches; but the wind died out, and their fish were as worthless to them as though they had been swimming in the sea. They were, almost without exception, unable to make the harbour. A few were provided with salt, which enabled them to preserve their herring, and to remain out for another night's fishing; but the next morning was as calm as before; and many of them again saw their catches lying comparatively worthless in their boats: for, even if salted, the curers would pay only half as much for them as for fresh herring. Two or three steamers had recently been purchased by Aberdeen parties, and fitted out for the herring fishery, and it was an aggravating sight to those who were depending on wind and sails to see the steamboats going by them to harbour to market their fish. He quite admitted that steam could be used with a decided advantage in the fisheries of any country where it was necessary to run to market in order to sell the fish while fresh. In America they began the capture of the Menhaden and other fish, which it was desirable to land fresh, with sailing vessels, but soon found it was difficult to get them to land in proper condition, and one after another the fishermen introduced steam, and within five years the entire fleet of sailing vessels in the Menhaden fishery was replaced by steamers.

Even in the herring fishery, although that was very limited and did not compare in any way with what he had seen in Scotland, steam had been introduced for collecting the fish, and in a few instances for vessels employed in catching them, and the results were found very satisfactory. He believed it possible for a Government to do much to encourage the fisheries by a judicious expenditure of money for such things as could not be expected from private capital. Improvements of harbours, the erection of lighthouses, fish culture on a large scale, and perhaps the introduction of improved methods of catching and curing fish, as employed in other countries, naturally belonged to the Government; but the building of curing-stands, and the purchase of nets and boats, belonged to private capital. There were undoubtedly instances where assistance to fishermen, in the form of loans with proper security, for the purpose of enabling them to obtain larger and more seaworthy boats, would prove beneficial, but, as a rule, he thought it was a decided mistake to lead fishermen to believe that they could do nothing until they were helped by Government. If leaders impressed them with the idea that they must remain idle until Government took some action, they were not only doing injustice to the fisheries but to the fishermen themselves. He could mention a number of instances in which American fishermen, with hardly a penny in their pockets, had begun to work, and to-day were men owning a fleet of vessels. They might have laboured under more favourable conditions than those of Ireland, doubtless they did in many instances, but certainly if the Irish fishermen, or indeed those of any country, came to realise that they must depend largely on their own energy and perseverance, it would be much better both for them and for the community in which they lived.

The vote of thanks having been carried unanimously,

Mr. BLOOMFIELD, in reply, said he was much obliged for the kind way in which the proposition had been made by his friend Mr. Blake, whose extreme kindness had shown that it was not necessary for Irishmen to be of the same opinion in politics in order to be appreciated by those who like themselves had the Irish interests at heart. There were only two points on which to touch with reference to the discussion which had taken place. Mr. Hornsby put it forward that they were to look entirely to the English and Scotch boats if they were to fish the whole coast of Ireland. He must say he demurred to that proposition. He believed it was possible for the same men, who it was proposed should go on board those boats, to show the English and Scotch what they were to do, and where they were to find the fish, if they got the opportunity to take the boat in hand and fish on their own account. It was because they had not the opportunities which were given elsewhere that they did not do so, and he must answer Mr. Earll's remark in the same way. As Mr. Blake had so properly observed there were no harbours of refuge along miles of coast, and if boats of English and Scotch owners could not come on that account it was utterly impossible for the poor Irish to engage in fishing there. They had heard from Mr. Earll how the inland fisheries had been developed in America, and it was only fair to ask why the Government should not be called upon to do something in the same way for Ireland. The United States had spent a large sum of money in bringing carp from Germany for the purpose of stocking their inland waters, and already 18,000 localities have been supplied with this fish. In conclusion he begged to move a vote of thanks to Lord Milltown for his kindness in taking the chair.

Mr. WALSH seconded the vote of thanks. He said Mr. Blake, who had given himself great trouble in connection with the fisheries of Ireland, had slightly misunderstood some remarks which he made in connection with the Irish fisheries. He did not say that they required State aid for the introduction of steam carriers; but he pointed out that these would be very useful. The State aid he asked for Ireland was in connection with what Mr. Blake now said was given, viz., the grant of £50,000 for the promotion of fishermen ownerships. That was a very small amount of money for such a purpose, and last year only £900 was given to the county of Cork, from which county over a quarter of a million pounds' worth of fish was shipped to England for food in fourteen weeks. In that respect they required larger aid from Government, but the aid he spoke of, as being particularly necessary, was in the matter of technical education with regard to net-making, boat-building, curing-houses, &c., and he was glad to find that his ideas with regard to this matter, and also the transmission of fish, were approved. He hoped these Papers and the discussions on them would do some good, and that the wants of Irish fishermen would not be altogether forgotten.

(The vote of thanks having been carried unanimously),

The CHAIRMAN said it had been a sincere pleasure to him to attend and to listen to the extremely interesting discussion. If he might be permitted to add anything personal, he might say that it was always a matter of sincere pleasure to contribute in however small a way to anything which would favour the cause of his dear native country. Mr. Bloomfield had made out a very strong case indeed, and had proved to demonstration the absolute ignorance which existed on the subject of Irish fisheries, and had also proved how little had been done by the Imperial Government towards their development. Mr. Blake had referred very slightly to the incredible injustice of past days, and it was impossible for any man, whether an Irishman or Englishman, to read of the record of that cruelty which destroyed the wholesale manufactures of Ireland, without feeling his blood boil with honest indignation at such atrocities being committed. It could not be denied that the Government of to-day, which, though not exactly the same Government as of those days, was its successor, and owed a reparation to those industries which it was easy to destroy, but often extremely difficult to re-habilitate. Mr. Bloomfield had given a case in point. He had alluded to the little port of Baltimore, which, owing to the generosity of Lady Burdett Coutts, had developed in an incredibly short time to a most important fishing-port. If so much could be done by private enterprise and benevolence, surely it became the Government of the richest Empire in the world to rescue people from that slough of despair into which a great portion of Ireland had been plunged for so many generations, and to raise them again into a position which they should occupy, and which, he was firmly convinced they would occupy without the necessity of foreign migration, or without further or more dangerous experiments in agricultural legislation. The Paper read by Mr. Walsh was one of extreme interest, he had given a succinct history of the fisheries of that part of Ireland with which he was specially connected, and brought forward very strong reasons indeed for Government assistance, and with regard to technical education and other points. He had also informed them of the enormous freightage charge from Milford and Holyhead for the transport of fish, and suggested that, as whisky and other goods were carried at a much lower rate, the railway companies should be compelled, as he understood him, to carry articles of food at a less rate than was now charged. But he really did not see how the Government could carry out that suggestion, or how they could be expected to compel the two railway companies to carry these goods at less rates than they chose to impose. The principles of political economy, although banished, as far as Ireland was concerned, to Saturn and Mars, in England held their full sway, and under these circumstances he could not help thinking that any attempt on the part of the Government to compel railway companies to carry these articles of food at a less rate than those they considered proper, would hardly meet with the sanction of Imperial Parliament. With regard to the interesting statement that Mr. Earll had made with regard to the inland fisheries of the United States, he thought there would be little difficulty in carrying out something of a similar nature in Ireland, where the lakes and rivers were, as far as affording food to the population, entirely unproductive.

APPENDIX.

I am indebted to Mr. Earll for the following statistics of the work of the United States Commission :—

"As the operations of the Commission have increased, and the propagation of additional species has been undertaken, it has been found desirable to increase the number of hatching stations. These are of two kinds, known as collecting and distributing stations. The former are located near the spawning grounds of those species for which they are especially intended. The eggs are secured at these stations, and enough having been reserved to stock the waters of that region, the remainder are sent to distributing stations, usually located at some central point, to be hatched and shipped to the waters for which they are intended."

The following is a list of the hatching stations operated by the United States Fish Commission in 1883 :—

1. Grand Lake Stream, Maine, station for collecting eggs of the Schoodic salmon (*Salmo salar* var. *sebago*).
2. Bucksport, Me., station for collecting and hatching eggs of the Atlantic salmon (*Salmo salar*), and for hatching eggs of the white-fish (*Coregonus clupeiformis*) to be distributed in the waters of the State.
3. Wood's Holl, Mass. Permanent coast station, which serves as a base of operations for the scientific investigations of the Commission, and as a hatching station for eggs of the cod (*Gadus morrhua*) and other sea-fishes.
4. Cold Springs Harbour, Long Island, New York. Station for hatching eggs of various species of salmonidæ for distribution in New York and vicinity.

5. Havre de Grace, Maryland. Station located on Battery Island, in the Susquehanna River, for the purpose of collecting and hatching eggs of the shad (*Clupea sapidissima*).
6. Washington, District of Columbia.
    - *a.* National Carp ponds. Ponds for the propagation of the three varieties of the carp (*Cyprinus carpio*), and the goldfish (*Carassius auratus*), the golden ide (*Idus melanotus* var. *auratus*), and the tench (*Tinca vulgaris*).
    - *b.* Arsenal ponds. Ponds for the propagation of carp (*Cyprinus carpio*).
    - *c.* Navy Yard. Station for collecting and hatching eggs of the shad (*Clupea sapidissima*).
    - *d.* Central hatching station. A station fully equipped for scientific experiments connected with the propagation of fishes. The station is also provided with apparatus for hatching the eggs of all of the more important species, including light, heavy, and adhesive eggs. It is the principal distributing station of the Fish Commission, for both eggs and young fish, to all portions of the United States.
7. Wytheville, Virginia. A station for hatching eggs of brook-trout (*Salvelinus fontinalis*) and California trout (*Salmo irideus*).
8. Saint Jerome's Creek, Point Lookout, Maryland. A station for the artificial propagation of the oyster (*Ostrea virginiana*), the Spanish mackerel (*Scomberomorus maculatus*), and the bandy porgy (*Chætodipterus faber*).
9. Avoca, North Carolina. A station on Albemarle Sound, at the junction of Roanoke and Chowan Rivers, for collecting, hatching, and distributing eggs of the shad (*Clupea sapidissima*), alewife (*Clupea vernalis* and *æstivalis*), and striped bass (*Roccus saxatilis*).
10. Northville, Michigan. A hatching station for the development and distribution of eggs of the white-fish (*Coregonus clupeiformis*). This station is also provided with tanks

and ponds for the spawning, hatching, and rearing of brook-trout (*Salvelinus fontinalis*) and California trout (*Salmo irideus*).

11. Alpena, Michigan. A station for the collection and development of the eggs of the white-fish (*Coregonus clupeiformis*).

12. Baird, California.

- *a.* Salmon station. A station on the McCloud River for the development and distribution of eggs of the California salmon (*Oncorhynchus chouicha*).
- *b.* Trout ponds. A station near Baird, for collecting, developing, and distributing eggs of the California trout (*Salmo irideus*).

13. Clackamas River, Oregon. A station on Columbia River for collecting and hatching eggs of the California salmon (*Oncorhynchus chouicha*).

"It is impossible from the data at hand to give detailed statistics of the work done at all of the stations above mentioned; a statement of the operations of three or four of the larger ones must therefore suffice.

"The hatchery at Northville, Michigan, under the direction of Mr. Frank N. Clark, passed into the hands of the United States Fish Commission in 1880, and is now one of the most important stations for salmonidæ in the world. It is provided with natural and artificial ponds in which brook-trout, rainbow-trout, land-locked salmon and lake-trout, are kept for breeding purposes. In addition to the eggs obtained from these ponds, many millions of eggs of the white-fish, lake-trout, and wall-eyed pike are obtained in the waters of Lake Erie, and forwarded to Northville to be hatched and distributed. During the season of 1882–3, 70,950,000 eggs of the salmonidæ, including white-fish, large smelt, in appine, were handled at this hatchery, a large percentage of which were hatched and distributed to different waters. A large refrigerator is being put in in readiness for next season's work, when it is expected that fully 500,000,000 eggs of the white-fish alone will be hatched.

"The hatcheries at Bucksport and Grand Lake Stream are both under the superintendence of Mr. Charles G. Atkins. The former of these is provided with ponds in which salmon, purchased from the fishermen of the Penobscot River, in May, are confined till November, at which time the eggs are taken and the fish liberated. At Grand Lake Stream, where the landlocked salmon is hatched, the eggs are obtained from the native fish which, when attempting to ascend to their natural spawning grounds, are turned aside into enclosures of netting, where they are retained until all of the eggs have been secured. There were secured at these two stations, during the past season, 3,675,000 eggs of these species for distribution to different parts of the United States.

"The hatchery on the McCloud River in California was established in 1872, under the superintendence of Mr. Livingston Stone, who has secured large quantities of eggs of the California salmon annually. The eggs have been taken from the wild salmon, which have been prevented from ascending to their natural spawning grounds by a dam which he has caused to be thrown across the river just above the hatchery. Eggs of the rainbow-trout also have been secured in considerable numbers.

"Owing to the lateness of the appropriation, little was done at the hatchery last year, only 4,000,000 salmon and 337,500 trout-eggs being secured. Most of these were hatched and planted in the waters of the Sacramento River. Mr. Stone gives the following comprehensive statement of the work accomplished since the establishment of the hatchery.

"In the eleven years since the salmon-breeding station has been in operation, 67,000,000 eggs have been taken, most of which have been distributed in the various States of the Union. Several million, however, have been sent to foreign countries, including Germany, France, Great Britain, Denmark, Russia, Belgium, Holland, Canada, New Zealand, Australia, and the Sandwich Islands.

"About 15,000,000 have been hatched at the station, and the young fish placed in the McCloud and other tributaries of the Sacramento River. So great have been the benefits of this restocking of the Sacramento that the statistics of the salmon fisheries on the Sacramento show that the annual salmon catch of the river has increased 5,000,000 pounds during the last few years.

"The shad stations at Washington, D. C., and Havre de Grace, Maryland, have been recently enlarged, and are now capable of holding immense numbers of eggs. At one of the Washington stations alone nearly 50,000,000 of eggs were received. An estimate of those for the other stations gives a total of over 70,000,000 eggs of this species.

"In 1877 the German carp was introduced into America by the United States Fish Commission. These were placed in ponds, especially prepared for them, at Washington and Baltimore. In 1880 the distribution of fry began, and up to January 1st of this year, the carp have been planted in no less than 17,860 localities. They prove to be especially adapted to our waters, and in some localities they grow with surprising rapidity. A fish, 4 inches long, placed in the waters of Texas, was found to have increased to 20½ inches in eleven months, at which time it weighed 4 pounds 11 ounces."

IMPROVED FACILITIES

FOR THE

CAPTURE, ECONOMIC TRANSMISSION AND DISTRIBUTION OF SEA FISHES;

AND HOW

THESE MATTERS AFFECT IRISH FISHERIES.

BY

R. F. WALSH

(OF KINSALE).

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CONFERENCE ON 30TH JULY, 1883.

EARL of MILLTOWN in the Chair.

IMPROVED FACILITIES FOR THE CAPTURE, ECONOMIC TRANSMISSION AND DISTRIBUTION OF SEA FISHES; AND HOW THESE MATTERS AFFECT IRISH FISHERIES.

IMPROVED facilities for the capture, economic transmission, and distribution of sea fishes, are, perhaps, the most important matters connected with sea fisheries, towards which the attention of the Government and of all persons interested in the food supply of the United Kingdom should be studiously directed.

It would be impossible, in the treatment of these subjects, to even touch on all of the great Fisheries of the British Isles. I therefore purpose to confine myself to the fisheries of the South and West of Ireland, and for reasons which I shall afterwards make more plain.

Before I proceed to the exposition of my ideas of the matters I have undertaken to write, I shall give a brief history of the fisheries I have elected to treat of. And, drawing conclusion from the facts that will be contained in it, I shall show that the harbours and fisheries of the South of Ireland have been neglected by the Government; that the fisheries there are amongst the largest and most productive in the United Kingdom, and that the insufficiency of funds, and consequently of enterprise, and the absence of proper accommodation, are alone to blame—that those fisheries do not successfully compete with the largest fisheries of the world.

In this brief history it will be seen that the extracts contained in it point to a curious but important conclusion, and that is, that the haunts of mackerel and herring (so far as the South of Ireland is concerned) do not change, as is accepted by most authorities.

And I am glad to state that the facts recorded in these extracts conclusively prove the importance of the South of Ireland for these fisheries, and a certainty of the best results from fishing operations there.

As far back as 1665 A.D., the fisheries of mackerel, herring, and pilchards were prosecuted at Kinsale with great success. The boats and gear used by the Irish fishermen at that time are not made particular mention of, although there are records of enormous catches of fish by them. But it is evident that, in point of size and completeness, the nets and boats of the fishermen of other countries, and notably of France, were much in advance of those used by the Irish, and I am scarcely wrong when I state here that the gear and general appliances of the French mackerel fishers of that period, excepting steam, were not inferior to those now used by our most scientific English, Manx, or Irishmen,—and that unless in some unimportant matters the improvements on the appliances of that time, by our islanders, have aimed rather to imitate, more or less, the plant of the French fishermen, than to make any stride towards innovation or more completeness of system. In making this statement you will of course understand that I do not allude to boats, for we all know well that vast improvements have been made, from time to time, on the models of that period.

In proof of the existence of great fisheries at Kinsale, in the 17th to 18th century, I give the following extracts from the 'Annals of Kinsale,' and I think they will be interesting—"14 June, 1672."—Sir Robert Southwell addressed a letter to Mr. Reeve, of Rotterdam, in which the following passage occurs concerning the Kinsale fishing: "His father . . . . in 1665, took £1300 worth of fish in one pull of a net." "Kinsale, 10 June, 1739," extract from letter of D. Furzer, to Mr. Secty. Burchett: "French fishing vessels . . . now come close to shoar to the number of 200 or 300 sail, from 60 to 80 tons, having each about 400 nets from 8 to 10 fathoms long. They come about the beginning of March (if the weather be good) and stay till towards the end of May."

From these extracts it will be seen that the French fleet of mackerel boats engaged in fishing off the Kinsale coast at that time numbered about 300, and that the nets of each boat were 400 in number, each measuring 8 to 10 fathoms, or, in other words, that the nets of each boat measured about 3 miles in length. So that, apart from the appliances of the native fishing boats, 900 miles of netting were employed by foreigners in the prosecution of the fishery early in the 18th century.

Further on in the letter I have quoted concerning the French boats, it appears that the natives were under the impression that the enormous size of the nets of the Frenchmen "interrupted the course of the mackerel and tended to break their shoals." Be that as it may, the mackerel have not left the coast, and their ground to-day is the same that it was two centuries ago.

Herring fishing, too, was carried on extensively in those days, and amongst the many records concerning this fishery, I find one of which the subject even now commands great attention, and justly so; it concerns the desirability of enforcing restrictive laws for herring fishing. I shall not entertain this subject in my paper, as it is a matter of dubious benefit, but as it may be interesting to know what were the ideas on the subject of the fishermen of former days, I give the extract:—

4th Oct., 1731.—"And whereas the Herring fishery is also greatly destroyed by persons fishing in spawning time, we present that no person fish for or take any Herrings or Sprats within the limits of this corporation before 29 September or after 1 January."

Thus it will be seen that two or three centuries ago mackerel and herring were captured with great success and with superior appliances on the Southern Irish coast.

Following the observations I made at the commencement of my paper, I shall proceed to show that on the same ground where those great fisheries existed centuries ago, the same fisheries are still carried on with success; that at all times since then the haunts of those fishes have been the same; how, for a time, the fisheries existed (to the same extent) no longer, and the manner in which they were revived and have since their revival been worked.

Shortly after 1739, the last date at which we have mention made of the presence of foreigners at the Kinsale mackerel fishery, the restrictions enforced by the Government for the protection of the native fishermen became so noxious that French and other fishermen elected to remain away. The result of this did not benefit the natives; they needed emulation, and at the same time several religious and political feuds occurring in the town, the fisheries were neglected, Irish fishermen and others were debarred from the privileges of the English settlers, and those great fisheries remained practically dormant until some twenty-five years ago.

Then a few Manx boats were sent over to Kinsale to "try" the ground, and the success of the experiment will be seen as I detail the entire working of the mackerel fishery on that coast, of the herring fishery there, and all the *minutiæ* of the particular points I have elected to write on, under the title of my paper.

The reasons why I have selected the fisheries of the South of Ireland will be manifest when I state that I have been for many years a director of the South of Ireland (now Kinsale) Fishing Company, Limited. And apart from this, I shall show by statistics that the fisheries of this coast are of such extent and importance, that a diagnosis of their operations and a few practical observations on improvements which can be made in the methods in use for the capture and transmission of fish, and on harbour accommodation there, will be of as great utility, for the purposes of this paper, as a general history of the fisheries of the United Kingdom.

In the year 1880—not counting Frenchmen—the number of boats engaged in the Kinsale Fishery was 722; in 1881, 652; and in 1882, 693. In size these boats averaged 27 tons each, and every boat carried *at least* 44 pieces of netting of 100 yards long, or 4400 yards of net—making in all somewhat over 1200 miles of netting for the fleet; or, in other words, the largest amount of netting in use in the world, so far as we can ascertain, at any one fishery, unless we regard the herring fisheries of Peterhead, Wick and Fraserburgh, &c., as one fishery—extending as they do, over an enormous extent of seaboard.

Of these boats one-half are Manx, one-third Irish, and the remainder English and Scotch.

This fishery begins about the first week in March, and continues until about the first of July—14 weeks. The number of fishermen employed in it is over 5000, and the entire number of men engaged in connection with the fishery is about 8000.

I have inquired as diligently as possible as to the quantity of mackerel caught in each season for five years, and have approximated the number to be about 31,500,000; these were sold by the fishermen at an average price of 15*s.* per hundred (of six score). These figures prove for themselves that the average amount of money paid for mackerel at Kinsale, per fourteen weeks (or season), for a period of five years, was over £250,000—a quarter of a million. And I have also authority to state that nearly one-fifth of this amount is paid for herrings at Kinsale between the months of May and August in each year.

These figures are collected, averaged, and approximated from official statistics, and therefore cannot be questioned. Taking into consideration the enormous supply of herrings that are to be found, and that are captured (when sought for) off Kinsale, it will seem unreasonable that Scotch and other fishermen do not prosecute the fishery after July.

At the time when the herring fleet leaves Kinsale, the largest "takes" are netted; but the herring fishery opens just then in places where curing houses and cheaper carrying rates occur, and naturally the merchants go to the ground where their profit is greatest.

On the south coast of Ireland there are *no* curing houses; herrings captured there have to be transhipped, in the same manner as mackerel, to some port where curing houses exist. It is questionable whether herring thus cured is so valuable as when *fresh* cured. Therefore, the Kinsale herring fishery is abandoned at a time when the quality of the fish admittedly surpasses that of any other fishery, and when the quantity is greatest, simply because the accommodation for curing the fish is not there. The food supply is curtailed by want of these curing-houses, the fishermen leaving the ground solely because of their absence.

In this there is room for practical Government aid. I have it on the highest authority that Kinsale herrings cured fresh are superior to most others. The *means* and enterprise for the erection of such factories are not at Kinsale. The establishment of such factories would yield a large profit to the projectors and builders—the Government could help to develop the scheme, and especially by judicious technical education. From a national point of view, it seems to me they ought to, and I can only hope that they will, give the matter their attention.

Having given an idea of the importance of the fisheries from which I propose to expose my digest of the improvements that can be made in the capture and transmission, &c., of sea fishes, I shall now attack the real theme of my paper, and I hope to point out matters that will be useful.

The nets used in mackerel and herring fishing are usually made of cotton, and various means are adopted to render the cotton lasting, the principal method being to "bark" them with an infusion of cutch.

They are also tarred, and are sometimes, for a time, used white. The latter is a Scotch method, for it is believed by some Scotch fishermen that one season's fishing with the unbarked cotton does not materially injure or affect its lasting properties; and after the one season they either bark or tar the nets—the former being the means usually adopted.

The action of the cutch infusion on the cotton, in the operation of barking, is somewhat similar to the tanning process in the manufacture of leather. It toughens the thread, and, penetrating the fibres of the cotton, covers it, so to speak, with a coating of cutch, and so renders it less open to the action of the salt water.

The tarring process has a somewhat similar effect on the cotton, but is not frequently adopted, and for various reasons, chiefest amongst which is the belief, or rather fact, that tar so covers up the exterior of the cotton and hemp of the netting and ropes, that faulty parts are indiscernible, and oftentimes good nets are lost by reason of those nearer on the roping giving way, or perhaps the rope itself.

Other preparations are recommended and sold for the preservation of netting, of which alum is the most useful. I believe that if the nets were for a season or two dipped in a solution of alum, instead of cutch, and afterwards barked, the cotton would be made to last longer, the expense of preserving the nets would be lessened, and a general saving obtained on the expenditure necessary to keep the nets in good order.

As I have already stated, the usual number of nets used by British mackerel fishers is 44, each net being 100 yards long.

The gear and construction and working of the nets, however, differ in many ways, and I shall here endeavour to point out which style has, over a period of twenty years, been found to be the most advantageous.

Each net is 100 yards long, and from 100 to 130 meshes, or 18 to 24 feet deep, and is usually made of 15-ply cotton thread. When in use, the 44 nets are joined together in the manner I shall now show, and form a continuous "string" of netting 4400 yards long. A few inches above the top of the net the floats are arranged. These are composed of small corks, about 3 to 4 inches square, and about an inch thick, and are fastened to the net by two ropes which run the entire length of the "string." These ropes are fastened to the net by means of cords called ossils, 400 of which are used for each piece of net, and the union of all these ropes and corks is called the "top line," or "top back," and serves to extend the nets and keep them afloat.

At the bottom of the nets another rope runs from end to end, and this is called the "foot line," or "sole rope." Suspended from this foot line, at distances of 50 yards, or half a net, are other ropes, each 27 feet long, and called "stoppers," and finally, at the bottom of the stoppers, runs a thicker rope, "the warp," or "spring back," which is used to haul the nets.

Some use stoppers, which extend from the top line downwards to the warps, but these are not so advantageous, as they tend to huddle the net together; whereas the stoppers and warps, being suspended from the sole line or bottom of the net, serve to keep the net strained to a sufficient degree.

Warps, &c., the full length of the nets are also used, but this is a mistake. It is always advisable to leave, say half a net free at the extreme end, for this steadies the line, and consequently the whole net swings more evenly. The "top line" is not held on board the boat, but the "spring back," or "warp" is, and also a heavy rope called the "swing warp" (about 50 yards long), which is fastened to the end of the "sole rope," and this steadies the whole arrangement when the boat is "lying to."

The herring nets are differently constructed and fewer, only 25 to 30 nets, of about 100 yards each being used, but they are *much* deeper than the mackerel nets, and not secured or floated similarly. There is no foot line or sole rope. All the connections are at the top. The small buoys that float the nets are secured to them by the stoppers, which are 5 or 6 fathoms long, so that the herring nets lie many feet under water.

About two fathoms above the nets the warp or spring back is run, fastened to the stoppers, and the net itself hangs free.

New nets require a little lead to sink them, but when they are in use for some time they sink readily themselves.

Having shown the construction of the nets, I shall now describe how they are worked, and point out improvements on the existing system.

In mackerel fishing the boat must, if possible, reach the fishing ground before sunset, as it is always desirable to "shoot" the nets before that time. The "ground" having been ascertained by the presence of gannets, puffins and oily-looking water, the nets are begun to be "shot" or thrown out, the boat still sailing. This process occupies about thirty-five minutes. When the net is "shot" the sails are lowered, and the mast too, and the boat "lies to" her nets until about an hour after midnight, when they are begun to be hauled in.

It is during this operation that much time is lost at the ground, for it takes from six to nine hours, according to the weather and quantity of fish, or the nets. Of late years various applications of steam have been used for hauling instead of the old windlass; and it is certain that steam winches cause a saving both of labour and of time, to a considerable extent. The nets are hauled in by a steam winch in about three hours; the mast is lowered and elevated by it, and so are the sails. Besides this, the boat carries one man less, and could, without inconvenience, dispense with two—so great a labour saver is the steam apparatus.

From this it will be seen that the application of steam for fishing purposes is proven a success, and should be encouraged and more generally adopted by our fishermen.

The cost of the steam winch is only about £70—one man's *share* or wages for one year would pay for it—it would be a permanent benefit to our boats, and I hope that the delays at the fishing ground are of the past, and that steam appliances will be generally adopted, and so render more easy the delivery of the fish, and improve and economise the general working of the fishery. Having explained the various ways in which nets are "cured" and worked, I come to the important portion of my paper dealing with the transmission of sea fishes, and particularly of mackerel, which is one of the most perishable.

As the mackerel season begins towards the middle of March, the weather is still cold and the fish does not need ice to preserve it until it gets to market; but as the season advances, a considerable amount of ice is used, and with this I shall deal afterwards.

When the fish is caught (at distances varying from three to forty miles off the land) the fishing boat makes sail for Kinsale, the headquarters of the merchants, or, if they happen to be too far west, towards Baltimore. The time occupied in reaching the harbour is long or short, according to the distance and wind.

At the mouth of Kinsale Harbour, 3½ miles from the town, they are met by the rowing boats of the buyers. If their catches are small they are transferred to the rowing boat, and the fishing boat returns to the fishing ground; and if large, they proceed to the inner harbour (losing the following night's fishing) to unload their silvery freight on board hulks (there being no pier), which serve as quayage and ice stores for the merchants. Here they are packed in boxes and iced, and again transferred to steamers or steam carriers, which take them to Milford, and thence by rail to the markets of London, Birmingham, &c. This brief sketch of what occurs between the time the fish is caught and when it is delivered at the central market for consumption, forms the chiefest portion of my essay, and I will divide it in four parts—1st. The improvements that are possible in bringing the fish from the fishing ground. 2nd. Improvements in steam carriers. 3rd. The cost of ice, freights, railway rates, &c., and how to lessen them; and, 4th. The necessity for proper fishery harbour accommodation.

It is easy to point out how improvements may be made in certain things, but the improvements are not always practicable. I hope I shall not deal in impossibilities; and although in the matter of mackerel fishing the first suggestion I make is an innovation, I believe it nevertheless to be decidedly practicable and advantageous.

Namely, if it sometimes, as it does, takes thirty to forty hours to sail from the fishing ground to harbour, thus making the fish (what is called) "over day," or stale fish, why not employ small steam fishing boats? The usual registered tonnage of a mackerel boat being thirty tons, the machinery necessary to propel it by steam would need an increase in the size, and raise or enlarge it to say forty-five tons, or even more. The price of a first-class, well-finished mackerel boat is about £600; double that amount, or a little more, ought to procure such a steam-boat as I suggest, and the saving in time effected by the change would not only ensure the best price for the fish, but, what is better, would enable the boat, unless under some extraordinary circumstances, to fish every night. These advantages must be obvious ; for taking into consideration the time that elapses between the time when the fish is caught, brought to harbour by the fastest sailing boats, and sold by the retailer in our great central markets, it is of the utmost consequence that the only period during the transfer where, unless by accident or want of carrying accommodation, delays can occur, namely, the bringing to harbour from the fishing ground, should be shortened as much as possible, and the fish delivered to the packers in the freshest possible condition.

Besides these great advantages the steam-fishing boat might earn large amounts by towing sailing boats to the harbour mouth, or even to the fishing ground when the wind was "slack" or contrary. In many of the Scotch herring fisheries the use of steam is largely applied, and I am informed that a few Scotch herring boats are propelled by steam, the steam, of course, being used only when necessary by reason of no wind or adverse wind. But the principle I have laid down, of the profits and benefits to be derived, outside the actual use of steam to the propelling of the boat itself, is conclusively proven by what occurs in those Scotch fisheries, and in this way—

Fish merchants not only employ steam carriers, but also steam tugs, which are used to tow sailing fishing boats to the harbour mouths and fishing grounds. I think this fact proves how beneficial would be the application of steam to mackerel fishing boats in the manner I have pointed out.

The improvements that might be made in steam carriers are, to my mind, few but important. Many plans of steam carriers have been devised and proposed—some of them are novel, and some have been tried.

Amongst the latter is the vessel with false hold or bottom, which allows the water to pass through with a view to bringing the fish alive to market. This style of carrier may be advantageous in some cases, but it is impracticable for the great mackerel and herring fisheries of the United Kingdom.

I have inquired from the best sources what improvements could be made on the existing style of carrier, and I have come to the conclusion that superior speed, extensive over-deck room, and the removal of the engines and boilers to a portion of the vessel the farthest possible from where the fish is packed and carried, are about the only improvements that can, or rather need, be made. These suggestions may take many forms, and I think the most important would be to provide carriers which, proportionate with size, could with the greatest speed carry the largest number of boxes of fish over deck, or in properly ventilated mid-deck compartments.

The rates charged for the transmission of fish by carrier owners, and particularly by railway companies, is really the subject on which a practical and necessary improvement should be made.

I shall illustrate this. At the Kinsale and South of Ireland mackerel fishery the following is the plan adopted by the fish merchants for conveying fish to London and the central markets:—

They hire steamers of say 250 tons register from Liverpool tug owners, at rates varying from £200 to £500 per week.

These steamers are not hired by individual merchants, but by companies (companies only so far as concerns the hiring of the steamers).

A rate for fish carrying is then struck; this includes icing, for these companies are large importers of ice for fishing purposes, and having finally agreed to rates with the different railway companies on the English side, the hirers of the steamers not only carry their own fish, but that of other and smaller merchants at a fixed rate (arrived at in the manner I have shown), which this season is 105*s.* per ton to London.

This 105*s.* is made up as follows:—40*s.* per ton of ten boxes (each containing 100 fish) for icing and freight to Milford, and 65*s.* per ton railway rate from Milford to London.

Thus, when mackerel are bought at 15*s.* per hundred, they cannot be delivered in London under 30*s.*, 4*s.* 6*d.* being added for cartage, &c., to the carrying rate of 10*s.* 6*d.* per box. The average cost of ice to the merchants is 15*s.* per ton cost and freight to Kinsale from Norway; but, allowing for melting, this really means 30*s.* per ton of workable ice. One ton of ice will suffice for twenty boxes, or two tons of fish (packed), so that allowing 15*s.* per ton for ice, the sender is charged 25*s.* per ton, or 2*s.* 6*d.* per box freight from Kinsale to Milford. This is not unreasonable, but the railway rate is, and should be remedied.

The cost of freight from Cork to London on other goods which come under the name of food and drinks is much less than that charged for fish. The freight on whisky is only 35*s.* per ton. This is not a particularly perishable article, but is liable to serious evaporation and loss of strength from exposure, &c.

Why then charge three times as much for the carriage of fish? It may be said that fish is three times, nay 100 times, more perishable; but this is not analogous.

Fish is dead weight—so is whisky; the former is the most perishable, but if the railway company cause no unnecessary delay in its transmission they run no additional risk by reason of its being perishable. This anomaly will be more clearly understood and appear more unreasonable when I state that in the case of fish carrying the railway companies have exceptional facilities for profit, without an extra rate, inasmuch as that it is shipped from Kinsale and its branches in sufficient quantities to load as many as three to four special trains, and, therefore, gives a *certain* traffic, at an exorbitant rate, against the uncertain traffic of the goods for which the same companies charge lesser rates.

I hold that it is unreasonable and unjust, and I also hold that goods which are used as food should be carried at as cheap or cheaper rates than ordinary merchandise. Let railway companies raise their rates for breakable or perishable merchandise; but food, without which we cannot live, should be carried at the lowest possible rate, and I think that this matter deserves the attention of those of the Government who are responsible for the public health.

It appears, too, from the fact of there being only two railway companies—viz.: at Milford and Holyhead—which carry to the English markets, that they hold a monopoly of traffic from the Irish mackerel fisheries, and charge what they like—and they do "like" a very large rate when they charge 65*s.* from Milford and Holyhead to London, and 80*s.* to some of the English markets from the same ports of landing. Not only does this railway monopoly affect the Irish mackerel fisheries, but also the important herring fisheries of Howth, Arklow, Ardglas, &c., on the eastern coast. This naturally impedes the development of Irish fisheries, as it is obvious that the freights and enormous railway rates necessitate a lower price being paid for the fish than is paid in more favoured districts.

Should this be? I think not, and I ask, will the authorities allow a railway monopoly to increase the price of food, and thereby preclude many from obtaining it? Certainly they should not, and I hope the Government will take steps to remove this barrier to the development of Irish fisheries, and thus help to increase the food supply of the United Kingdom.

I now come to the concluding portion of my paper, and I shall devote it, as I have explained, to an exposition of the insufficient fishery accommodation on the Irish coast. When I began this essay, I stated that the Government had neglected the fisheries and harbour accommodation of the south of Ireland. I now state authoritatively that the fishery population and fisheries of that portion of the United Kingdom, and particularly of Kinsale and its branches, have, with some few unimportant exceptions, never been encouraged by the Government; nor have they proposed to the fishers of those districts any scheme which by Government aid would develop the wonderful and important food resources of the mackerel, herring, and other fisheries I have written of.

In illustration of how pier and harbour accommodation has been neglected by the Government, I shall give a brief outline of the history of the Kinsale fishery pier and sea-wall.

In 1878, after many years of petitioning and seeking, a Bill was passed by Parliament, granting to the Kinsale Harbour Commissioners a sum of £7500, and providing that a further sum of £6500 should be advanced on loan by the Irish Board of Works, and also permitting the Kinsale Harbour Commissioners to expend a sum of £2000 from their funds, all for the purpose of building a fishery pier and sea-wall. During the five years since that Bill was passed, reams of letters and deputation after deputation were sent from Kinsale to the Board of Public Works to hasten on the commencement of the pier. "Red tapeism," however, had to be wound and unwound its accustomed (in this instance, I have to believe, unaccustomed) length. Obstacles of easy removal were made mountains of; a few hundreds extra swelled to thousands —so far as the difficulty of obtaining it, even a loan, from the Government, was concerned; and despite the importance of the fishery which waited for the pier, and the fact of its admitted necessity, it has been commenced to be built only since this paper was written.

From what I have said of the non-encouragement of Irish fisheries by the Government, it may appear to some persons that the story of this pier and the Government grant is a contradiction of such a statement. But I speak of *encouragement*, and, in my opinion, it is not encouragement, either on the part of a Government or an individual, when it takes many years to *extract* help from them for such a purpose.

Travelling through Scotland and the North of England, I was struck with the accommodation afforded by the Government to the fisheries there, in the shape of State-aided harbours, piers, &c.

Why the same advantages should not be extended to Ireland, I know not. However, I shall point out *where* the Government *could* improve the fishery accommodation on the southern Irish coast, and then I have done.

When dealing with the transmission of fish, I pointed out the distance from the land at which fish are caught, and showed the delay that occurs at Kinsale by reason of insufficient accommodation of one kind or other. Now I believe that on no more fitting place could the Government expend some thousands in development of fisheries, and for aiding the quick transmission of fish to market, than here.

At the north of Kinsale Harbour there are two points—Hangman and Money Points—one on the eastern and the other on the western side of the entrance. The railway at Kinsale terminates at the eastern side of the inner harbour; and it would be a saving of hours, perhaps one night's fishing, to the boats if a fishery pier were built at this eastern point, and connected either by rail or tramway with the railway and the already proposed inner or town fishery pier.

At Baltimore, Youghal, and Crookhaven, piers or harbours might also be made by Government aid, with peculiar advantage to the fisheries on the coast, and safety to the lives of the fishermen.

Two hundred and fifty thousand pounds worth of fish shipped from this coast in three months feed a great many mouths in England. The quantity of food obtainable might, by judicious help from the Government, be more than doubled. I have pointed out how the fisheries might be aided; I have recommended steam fishing-boats, improved carriers, moderate railway rates, and improved and sufficient harbour and pier accommodation. All these might the Government help to accomplishment. It is, in a great measure, in their hands to increase the food supply of the United Kingdom by these means. I ask, almost incredulously, will they do it?

Since this portion of my paper was written, I am glad to state that the Government have made one good effort towards the ends to which I have alluded, namely, by their promotion of the Irish Fisheries and Harbour Bill, 1883. Irishmen of every class and creed and shade of political opinion are grateful for it, although the £250,000 appropriated to the improvement of Irish fishery harbours, &c., by this bill, was already the property of the people of Ireland. And I do hope that, in the disposition of the grants and loans, under this Act, very great care will be taken that piers and harbours will only be built where there is the greatest necessity for them; and that the importance of the fishery, and the necessities of the locality, will in each case be studied before deciding on any works of importance. But there still remains even a more important want, namely, encouragement for our fishermen—encouragement by means of help for curing-houses, State-aided ownerships for fishermen, and above all, State-aided technical education in those branches of craft and trade connected with net-making, boat-building, and the curing and preserving of fish.

Here, then, is the solution of the wished-for success of our fisheries. Encourage our young men and young women in those arts and crafts which tend towards the development of one of the most important, perhaps the most important, branches of commerce.

And I ask you, my lord, and those amongst you, gentlemen, who are listening to me, and by whose influence these ends can be approached, to help us in the good work, and to ask for us that State aid which is a necessity for our success. We in Ireland, who get so little, are not easily disappointed; but I hope the Government will give us a pleasant surprise by helping us in our fisheries and in the technical education of our fishermen and fishwives. By doing this they will be supporting a national, as well as an Irish, industry; they will ensure a greater supply of food for their subjects, and they will help to support, not only the families of Irish fishermen, but the thousands who do, and the many thousands who could, derive a living from the proper development of Irish fisheries.

DISCUSSION.

Mr. HORNSBY said from the extreme point on the east coast at Ardglas there was a long expanse of coast-line which was not fished from May until the close of the year. Mr. Walsh accounted for it by stating that the Kinsale fisheries were first promoted by a tentative effort to ascertain whether they would be worth pursuing after they had lapsed for some years. Now the west coast was in exactly the same condition. Those who fished at Kinsale were chiefly from Scotland and the Isle of Man, and they returned from there, following the direction of the fish salesmen, to other parts of the coast-line, chiefly to the east coast to prosecute their fisheries there, under the direction and stimulus of the fish-curers, and under the patronage of the fish salesmen. For example, the Scotch east coast fishermen, who fished on the Norway coast during the winter, came to the Kinsale and Howth fisheries for the month of April or May, and then in July they went to Peterhead, Aberdeen, and other places, as directed by the fish-curers. They were retained for this purpose, a subsidy being given them, and they remained there until they had secured a certain amount of fish; if they did so within the time contracted for they were free to fish on their own account. Afterwards they went to the southern ports, such as Lowestoft and Harwich. The fishermen on the west coast of Scotland, Campbeltown, and Loch Fyne, were accustomed to fish in the same way, but of late years those fisheries had been failing; some of the men at Campbeltown owned thirty or forty boats, and they were prepared to try the west coast of Ireland, but who was to induce them to do so? The fish salesmen would not attend them there until they had proved the fisheries would be successful. Therefore there seemed to be a missing link, and the question was, who was to promote the general movement of fishing boats attending the west coast of Ireland? The whole coast was peopled with hardy fishermen, who, as Mr. Brady had said, were remarkable for their honesty and hardihood; he wished he could say as much for their persistent industry; but these men were very teachable, and if you had Scotch boats along the west coast of Ireland for the present month up to the end of September or the middle of October they would no doubt be glad to take one or two native fishermen as pilots, who would in that way pick up a little technical education, and would be instructed in the art of following fish to a considerable distance from the coast. Last week he was talking with some men of this class off Clew Bray near Achil Point, the furthest on the west coast of Ireland. He found there the appliances they had for fishing were the native coracles. If these men could be taken on board the Scotch fishing vessels and taught, in the course of time, with a little assistance from the State, they would invest their money in hookers and larger boats. The question was, who was to instruct these men? At present they only fished with these coracles; they went out to a bank perhaps five miles off the coast, and that was the last of their enterprise. The reason these boats were generally used was that they would ride in about a foot of water, they passed readily through the surf, and could be easily taken up and carried on their backs when they got on shore. He thought Mr. Walsh's idea, if it could be carried out, of having a steam carrier for going from port to port to collect the fish, would be very good, otherwise it was often thrown on shore to rot. There might be tons and tons of herrings thrown on the shore because there were no means of sending them to market. Again, another missing link with regard to these Irish fisheries was this, if Scotch or Cornish boats were to come to the south or west coast of Ireland there might be harbours of refuge as near as possible to the fishing grounds, provided by and under the control of the Government, and, on the other hand, there must be light tramways to connect the more distant parts with the established railway termini. The charts in the British section would explain why it was from the month of May or June to the end of the year the west coast fishery was practically not prosecuted; the fish were there and were not caught, first, because the men were not there, and, secondly, because the fishing grounds were so distant from any harbours.

Mr. J. A. Blake, M.P., proposed a vote of thanks to the two gentlemen who had read Papers. As an Irishman he was very much interested in the fisheries, and felt much obliged to both gentlemen for the most interesting and valuable Papers they had read. No man in Ireland was more entitled to speak on industrial subjects than Mr. Bloomfield, because no one had made greater efforts in that direction than he had. It was more than a quarter of a century since he had been associated with him in an effort for the extension of railway accommodation in Ireland, and for the State to purchase the railways; it was a great misfortune for Ireland that this was not done, and also for the State, because they would have paid very well. He was very glad indeed for the sake of the fisheries to find that Mr. Bloomfield had taken up this question, and every one who had heard the Paper would agree with him that he had dealt with it in a very exhaustive manner. He was sorry to be obliged to say, that there were very few men occupying a high social position in Ireland who took any practical interest in this question, and, therefore, Mr. Bloomfield's Paper was all the more welcome. The Paper read by Mr. Walsh was also of a most important character. He was practically engaged in the fishery enterprise in the south of Ireland, and had shown how it could be made to pay. The interest in this subject was not confined to Ireland, it was of national importance when one considered the vast amount of fish consumed in the United States. He had taken great trouble to prepare a statement, which he would put before the House of Commons, showing the aggregate amount of fish consumed in the United States, and it amounted to the enormous quantity of twelve millions a year; that was chiefly sea fish, and was entirely independent of importations from Norway, Newfoundland, or elsewhere, in the preserved condition. Out of that total the amount captured by Englishmen was eight millions sterling, Scotland three millions, and not more than half a million for Ireland, and of that a considerable portion was taken by Manx, Scotchmen, and Cornishmen; and even the French fishermen came in considerable numbers to the Kinsale coast. It seemed very strange that Ireland should contribute so little to the national larder, when it was asserted so often that there was no diminution of the quantity on the coast, and, from his experience, he believed such to be the fact. In old times the English monarchs had derived large revenues from allowing foreign nations to fish on the Irish coasts. In the time of Charles £8000 was given by the Spanish monarch to allow a certain number of Spanish vessels to fish there, and in about 1640 the Swedish Government, in return for services rendered to England, was allowed to send a certain number also. Frenchmen and Flemings fished extensively there, and the important pilchard fishery, which Mr. Walsh had not touched upon, was carried on very extensively by the Dutch, and even now in certain parts of the county of Cork there were remains of what were called fish palaces, where the Dutch used to cure the fish. He did not wish to awaken old and bitter memories, but it was quite impossible, in dealing with the fishery question, to omit the fact that down to a very recent period, so far from the fisheries being encouraged by the Government, they were absolutely discouraged and depressed. It seemed to be the idea that the fisheries of Ireland were to be for the benefit of every one save and except the Irish themselves. The Cromwellian Parliament was inundated with petitions that the Irish fisheries might be suppressed in consequence of their competition with the English, and under a commonwealth ordinance there was an immense amount of suppression; many fishermen were sent to Connaught, and others transported to Barbados and the other West Indian islands. He would not go further into these matters, but he merely stated them for the purpose of showing that there was a strong claim on Imperial assistance now, for the purpose of forwarding the long-neglected and even repressed Irish fisheries. One circumstance would prove why these fisheries ought to be helped as a matter of Imperial interest. It was an unquestionable fact that the fisheries in the North Sea were considerably diminishing, and at this moment, or very lately, there was a Royal Commissioner nominated for the purpose of inquiring into the cause of this diminution of fish in the North Sea. Under such circumstances it was most desirable that the fishing resources of Ireland should be developed to the greatest possible extent. There were only £500,000 worth captured, and that quantity might be readily augmented tenfold. The previous speaker had alluded to the very small amount to which the west coast of Ireland was utilised for the purpose of fish capture, but there was no doubt that arose from the want of sufficient harbours. From the mouth of the Shannon to Galway Bay, about seventy miles, there was only one indifferent harbour on the coast of Clare. For thirty-five miles, from Galway to Liscanor Bay, there was no harbour which would accommodate a boat of even ten tons, and from there again to the mouth of the Shannon there was an equal absence of harbour accommodation. Fishery companies had been established for the purpose of fishing the west coast, but they had all failed, chiefly from this cause, because, owing to the tempestuous character of the sea, the crews were often obliged to remain for weeks in a state of enforced idleness, and he was sorry to say that they then often resorted to the public-house to kill time, so that when the water was suitable they were not in a fit state for resuming their labours. He was happy to say that, owing to a very important vote lately passed for granting out of their own money, the Church Fund, £250,000, the want was likely to be supplied, and he had no doubt as a consequence very important fishery enterprises would be established. It was quite out of the question for men to think of getting boats suitable for fishing in those tempestuous seas, if there were not adequate harbours to seek shelter in. Another important point as mentioned by Mr. Walsh was the great inconvenience and loss which in the south of Ireland a fleet was put to by being obliged to come into harbour with each cargo of fish, and there was no doubt that an immense improvement would be made if steam power were employed. That, however, must be a matter of private enterprise. All that the Government could be expected to do was to provide the means for harbours. Then he spoke of the great want of more suitable boats and gear, but there were two sources of supply now in operation. The inspectors of fisheries had a fund of £500,000, from which fishermen could borrow at very moderate interest for the purpose of supplying boats and gear. Since that fund had been in operation, the inspectors of fisheries had lent out about £50,000 to the fishermen of Ireland, and, very much to the credit of those men, the whole of that sum had been paid back with the exception of about £1000, and even that very small sum would not now be outstanding if adequate means had been taken for its recovery. Besides that, there was a Society in Dublin which had £30,000 or £40,000 at its disposal for the same purpose. An important provision had been introduced last year, enabling the inspectors instead of lending money to advance it in the shape of boats and gear, which was a great improvement, because he was afraid some of the money was often applied to very useful purposes, such as portioning their daughters, paying rent, enclosing land, and such like. Now the borrowers were debarred from that kind of thing, and instead of getting the money obtained the same assistance in kind, which would tend very much to the advancement of the fisheries. He had a very well-grounded hope that there was a great future for the fisheries of Ireland. It was much to be deplored that there had been a very great decrease, owing to causes which he would not stay to enumerate in detail, but subsequently to the famine the numbers of fishermen were reduced from 113,000 to 25,000, and the boats from 20,000 to 6000 or 7000; still he had strong belief that with the means now placed in the hands of inspectors of fisheries a great stimulus would be given to the enterprise, and that many other industries, such as boat-building, sail-making and net-making, would be put in motion also. It was not Ireland alone which would benefit by the promotion of this industry, but the United Kingdom also would participate by having a very largely increased quantity of the most wholesome food contributed from the Irish seas.

Mr. EARLL seconded the vote of thanks. Those who had paid attention to the questions which had come before the Conferences must be more deeply convinced than ever of the importance of the fisheries, and of the necessity of the utmost caution in all questions of fishery legislation, for fisheries, though little understood, now rank among the principal industries of the world. They had had to-day two Papers by gentlemen evidently deeply interested in the subject. Mr. Bloomfield had spoken of the possibility of increasing the supply of fish in the inland waters of Ireland, and had referred in very flattering terms to the United States Fish Commission, and to their method of stocking inland waters. It was found in a country like the United States rather difficult to get the best quality of fresh fish sent from the sea-board for 1500 miles into the interior, and Professor Baird, who was at the head of the U.S. Fish Commission, determined to see if he could introduce some fish that might answer as a good and substantial food for the people of the interior who were deprived of the fish of the ocean. He, therefore, sent to Germany, and secured a quantity of German carp, which he thought might be adapted to the inland waters. These were imported at the Government's expense, kept in ponds, and artificially propagated until a sufficient quantity had been raised to warrant their distribution to the smaller waters of the interior. As soon as the supply was sufficiently large, the distribution began, and year after year it had increased, until, at the close of 1882, German carp had been introduced into upwards of 18,000 different localities scattered over all portions of the United States. It was at first considered doubtful whether these fish would be suited to American waters, and it was therefore decidedly desirable for the Government to undertake the experiment of their introduction, for no private individual or company would feel justified in hazarding their funds on such an uncertain venture. He was happy to say that the efforts of Professor Baird had proved successful beyond expectation. The German carp were found to increase more in size in the waters of Florida in eighteen months than they did in their native waters in four years. Thus it was found possible to introduce valuable food-fish into the inland waters of America—and under that term he included mill-ponds, and the little ponds on the lands of the farmer—for many farmers were now clearing the rubbish out of their little ponds, and were sending to the Commission to obtain a supply of carp which was given them gratuitously, and many were now raising them successfully, frequently distributing the young to their neighbours gratuitously, or selling them at a low price. He thought it would be quite possible to do the same in the inland waters of Ireland. Mr. Walsh had made many suggestions, some of which were very valuable, especially that relating to the introduction of steam into the herring fishery. Only last week he had visited the coast of Scotland with the express purpose of studying the herring fisheries of that region. He not only visited the fishing ports, but went out both upon a steam-trawler, and upon a herring-boat, to see the methods adopted for catching fish. At Aberdeen—the port from which he sailed—about 500 vessels started, and proceeded to sea, some 30, some 40, and some 50 miles. The fish were fairly plentiful, and a number of the boats secured good catches; but the wind died out, and their fish were as worthless to them as though they had been swimming in the sea. They were, almost without exception, unable to make the harbour. A few were provided with salt, which enabled them to preserve their herrings, and to remain out for another night's fishing; but the next morning was as calm as before; and many of them again saw their catches lying comparatively worthless in their boats: for, even if salted, the curers would pay only half as much for them as for fresh herring. Two or three steamers had recently been purchased by Aberdeen parties, and fitted out for the herring-fishery, and it was an aggravating sight to those who were depending on wind and sails, to see the steamboats going by them to harbour to market their fish. He quite admitted that steam could be used with decided advantage in the fisheries of any country where it was necessary to run to market in order to sell the fish while fresh. In America they began the capture of the Menhaden and other fish, which it was desirable to land fresh, with sailing vessels, but soon found it was difficult to get them to land in proper condition, and one after another the fishermen introduced steam, and within five years the entire fleet of sailing vessels in the Menhaden fishery was replaced by steamers.

Even in the herring fishery, although that was very limited and did not compare in any way with what he had seen in Scotland, steam had been introduced for collecting the fish, and in a few instances, for vessels employed in catching them, and the results were found very satisfactory. He believed it possible for a Government to do much to encourage the fisheries by a judicious expenditure of money for such things as could not be expected from private capital. Improvements of harbours, the erection of lighthouses, fish culture on a large scale, and perhaps the introduction of improved methods of catching and curing fish, as employed in other countries, naturally belonged to the Government; but the building of curing-stands, and the purchase of nets and boats belonged to private capital. There were undoubtedly instances where assistance to fishermen, in the form of loans with proper security, for the purpose of enabling them to obtain larger and more seaworthy boats, would prove beneficial, but, as a rule, he thought it was a decided mistake to lead fishermen to believe that they could do nothing until they were helped by Government. If leaders impressed them with the idea that they must remain idle until Government took some action, they were not only doing injustice to the fisheries, but to the fishermen themselves. He could mention a number of instances in which American fishermen, with hardly a penny in their pockets, had begun to work, and to-day were men owning a fleet of vessels. They might have laboured under more favourable conditions than those of Ireland, doubtless they did in many instances, but certainly if the Irish fishermen, or indeed those of any country, came to realise that they must depend largely on their own energy and perseverance, it would be much better both for them and for the community in which they lived.

The vote of thanks having been carried unanimously,

Mr. BLOOMFIELD, in reply, said he was much obliged for the kind way in which the proposition had been made by his friend Mr. Blake, whose extreme kindness had shown that it was not necessary for Irishmen to be of the same opinion in politics in order to be appreciated by those who, like themselves, had the Irish interests at heart. There were only two points on which to touch with reference to the discussion which had taken place. Mr. Hornsby put it forward that they were to look entirely to the English and Scotch boats if they were to fish the whole coast of Ireland. He must say he demurred to that proposition. He believed it was possible for the same men, who it was proposed should go on board those boats, to show the English and Scotch what they were to do, and where they were to find the fish, if they got the opportunity to take the boat in hand and fish on their own account. It was because they had not the opportunities which were given elsewhere that they did not do so, and he must answer Mr. Earll's remark in the same way. As Mr. Blake had so properly observed, there were no harbours of refuge along miles of coast, and if boats of English and Scotch owners could not come on that account, it was utterly impossible for the poor Irish to engage in fishing there. They had heard from Mr. Earll how the inland fisheries had been developed in America, and it was only fair to ask why the Government should not be called upon to do something in the same way for Ireland. The United States had spent a large sum of money in bringing carp from Germany for the purpose of stocking their inland waters, and already 18,000 localities had been supplied with this fish. In conclusion, he begged to move a vote of thanks to Lord Milltown for his kindness in taking the chair.

Mr. WALSH seconded the vote of thanks. He said Mr. Blake, who had given himself great trouble in connection with the fisheries of Ireland, had slightly misunderstood some remarks which he made in connection with the Irish fisheries. He did not say that they required State aid for the introduction of steam carriers ; but he pointed out that these would be very useful. The State aid he asked for Ireland was in connection with what Mr. Blake now said was given, viz., the grant of £50,000 for the promotion of fishermen ownerships. That was a very small amount of money for such a purpose, and last year only £900 was given to the county of Cork, from which county over a quarter of a million pounds' worth of fish was shipped to England, for food, in 14 weeks. In that respect they required larger aid from Government, but the aid he spoke of, as being particularly necessary, was in the matter of technical education with regard to net-making, boat-building, curing-houses, &c., and he was glad to find that his ideas with regard to this matter, and also the transmission of fish, were approved. He hoped these Papers and the discussions on them would do some good, and that the wants of Irish fishermen would not be altogether forgotten.

(The vote of thanks having been carried unanimously),

The CHAIRMAN said it had been a sincere pleasure to him to attend and to listen to the extremely interesting discussion. If he might be permitted to add anything personal, he might say that it was always a matter of sincere pleasure to contribute, in however small a way, to anything which would favour the cause of his dear native country. Mr. Bloomfield had made out a very strong case indeed, and had proved to demonstration the absolute ignorance which existed on the subject of Irish fisheries, and had also proved how little had been done by the Imperial

Government towards their development. Mr. Blake had referred very slightly to the incredible injustice of past days, and it was impossible for any man, whether an Irishman or Englishman, to read of the record of that cruelty which destroyed the wholesale manufactures of Ireland, without feeling his blood boil with honest indignation at such atrocities being committed. It could not be denied that the Government of to-day, which, though not exactly the same Government as of those days, was its successor and owed a reparation to those industries which it was easy to destroy, but often extremely difficult to rehabilitate. Mr. Bloomfield had given a case in point. He had alluded to the little port of Baltimore, which, owing to the generosity of Lady Burdett Coutts, had developed in an incredibly short time to a most important fishing-port. If so much could be done by private enterprise and benevolence, surely it became the Government of the richest Empire in the world to rescue people from that slough of despair into which a great portion of Ireland had been plunged for so many generations, and to raise them again into a position which they should occupy, and which, he was firmly convinced they would occupy, without the necessity of foreign migration, or without further or more dangerous experiments in agricultural legislation. The Paper read by Mr. Walsh was one of extreme interest; he had given a succinct history of the fisheries of that part of Ireland with which he was specially connected, and brought forward very strong reasons indeed for Government assistance, and with regard to technical education and other points. He had also informed them of the enormous freightage charge from Milford and Holyhead for the transport of fish, and suggested that, as whisky and other goods were carried at a much lower rate, the railway companies should be compelled, as he understood him, to carry articles of food at a less rate than was now charged. But he really did not see how the Government could carry out that suggestion, or how they could be expected to compel the two railway companies to carry these goods at a less rate than they chose to impose. The principles of political economy, although banished, as far as Ireland was concerned, to Saturn and Mars, in England held their full sway, and under these circumstances he could not help thinking that any attempt on the part of the Government to compel railway companies to carry these articles of food at less rates than those they considered proper, would hardly meet with the sanction of the Imperial Parliament. With regard to the interesting statement that Mr. Earll had made with regard to the inland fisheries of the United States, he thought there would be little difficulty in carrying out something of a similar nature in Ireland, where the lakes and rivers were, as far as affording food to the population, entirely unproductive.

SEAL FISHERIES.

BY

CAPTAIN TEMPLE.

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CONFERENCE ON FRIDAY, JULY 6TH, 1883.

The Chair was taken by SIR JOHN ROSE, G.C.M.G.

The CHAIRMAN said the subject of the paper to-day was seals and seal fisheries, an industry which was not confined to any special part of the world. He would not attempt to anticipate the interesting paper about to be read by Captain Temple, but he might be permitted to refer to one circumstance connected with the subject in a word or two. They had all read lately with deep interest a report that a portion of the Newfoundland fishery fleet had been imbedded in the ice off Labrador, which, of course, excited painful interest in the minds of everyone connected with that branch of industry, and profound sympathy with the men engaged in it. From what he heard, he believed there was not only a hope, but very strong expectation that these men would pull through, and that in a few days they would receive good news that the fleet had escaped from the ice. The ice-packs on that coast disappeared as rapidly as they formed. A change of wind or a current would give them clear weather almost immediately, and he hoped they would not only come back in safety, but with a bounteous reward for their energy and perseverance.

SEAL FISHERIES.

Mr. CHAIRMAN, Ladies and Gentleman.—The subject of to-day's discussion is one capable of great elaboration, and it will be impossible, in the limited time at our command, to do more than take a very cursory glance at it.

There is no sea upon the surface of the globe in which seals are not to be met with ; not in the breadth of the great oceans, indeed, between the shores, though they are capable of taking journeys of considerable length ; they are most abundant upon the shores of the dreary lands in the high latitudes, and near the margins of the ice, and in the north they form an important article in the domestic economy of the inhabitants of those inhospitable climates. In the high latitudes, both north and south, the seals are essentially gregarious. In the temperate latitudes they assemble in groups, but not in very large numbers, while in the equatorial seas the seals are solitary, or seen at the most in pairs.

In the Dominion of Canada, where sealing is, and has been for years, carried on extensively, there are three varieties of seals to which I desire to draw your attention : the harbour seal, the harp seal, and the hooded seal.

The herds of seals which frequent the Gulf of St. Lawrence arrive there in the month of November. They come chiefly through the straits of Belle Isle ; they hug the shores either of Labrador or of Newfoundland, penetrating into all the bays, and not going far from land when doubling the capes and headlands. In the winter they spread themselves through the gulf in search of icebergs, on which they live for several months. In the months of May and June they appear on the coasts, but this time they pursue an opposite course to that adopted by them on their arrival. On their final departure from the coast, they go out of the gulf into the main ocean, and probably repair to Hudson's Bay and the Arctic seas.

The importance of the seal fisheries was soon perceived by the first mariners who visited the Gulf of St. Lawrence, for shortly after Canada was discovered, seal-fishing was extensively prosecuted by the settlers, and from those days it has been recognised as one of the most important branches of industry pursued in those latitudes.

The mode of capturing the seal in Canadian waters is by netting them. The nets used are made of hempen cord, which is very strong, although not more than the twelfth part of an inch thick. The meshes are eight inches square. Some of these nets are more than one hundred fathoms long by ten fathoms wide, and several nets are put together, as advantageously as possible, for the purpose of taking the seals. Some of these nets are of great value, costing, for the net alone, £1,500, exclusive of the anchors and gear, by which they are kept in position after they are set.

The usual time for the seals to pass near the shore on their migratory voyage being known, the nets are set a few days before; one of the fishermen is posted as a sentry on a rock, a little in advance of the fishery, to give notice of the approach of the herds of seals, and the moment they are within the fishery a signal is given, and the fishermen hasten to raise, by means of capstans, a net sunk by leaden weights to the bottom of the water at the entrance of the fishery. With this net they close the entrance through which the seals made their ingress, and as soon as this operation is completed, and the seals are fairly imprisoned, the fishermen jump into their boats and enter the fishery, shouting and beating the water with their paddles, and sometimes firing off guns. The frightened seals, trying to escape, dive down and run their heads into the meshes of the net, which are kept always open by means of roping round the borders of the net, hove taut and set up by capstans. As soon as the seals are caught in the meshes the men underrun the nets, knock on the heads the seals that are not strangled, and carry them on shore in their canoes.

The autumn fishing on the Labrador Coast takes place at the end of November and in the month of December, and is very arduous, by reason of the severity of the weather and of the ice fields, which often break through and destroy the nets, if care is not taken to haul them up in time. The seals at this season, on being taken out of the water, become frozen, and in that state they are stored, and it is not before the spring, when the warm air has softened them, that they are cut up and the fat melted.

The spring fishing is carried on with nets in nearly the same manner, with this difference, however, that the entrance to the fishery is to the westward, because at that season the seals are going out of the gulf.

The spring and autumn fishings are carried on with nets from Blanc Jubleris Bay to Cape Whittle.

The seals are not only taken with nets, but they are also pursued in every direction, and are sought for on ice-fields in the Gulf of St. Lawrence and in the Atlantic, at a considerable distance from Newfoundland and the Isle of Cape Breton.

The expeditions that are fitted for that kind of fishing, or rather of hunting, require to start early in the spring.

Sealing is carried on, on a very large scale, in Newfoundland, and it is only, we may say, by the fishermen of Magdalen Island that the hunting for seals in Canada is carried on. The take of seals in the Canadian fisheries last year was 75,000.

Seal hunting, or fishing, as it is often called, requires great patience and skill. Most of the seals, if not all, are gregarious, and one seal seems to be always on the watch where danger is to be apprehended from bears, or from hunters. They climb up through holes in the ice-fields of the polar seas, even when there is a height of several feet from the water ; but it is difficult for the hunter to get between them and the hole. Nor is seal-hunting unattended with danger, an enraged seal being a formidable antagonist, at least to the inexperienced.

The fishing I have above referred to is entirely the hair seal fishing, the object of which is to secure the oil and the hide, the former remarkably good and clear, and only second in quality to the oil of the sperm whale, and the latter giving useful and durable leather. I will, with your permission, take you from the far north to the far south, and we will have a look at another seal-fishing industry—the fur seal fisheries of Southern Patagonia. Reference to the map will show you that the western shore of Patagonia, from the island of Diego Ramirez to the Gulf of Tres Montes, is studded with islands and islets, some of them washed by the stormy waves of the Southern Pacific, and some of them sheltered in almost land-locked bays and inlets. Upon these islands and rocks are to be found, during a certain season of the year, rookeries of the South Sea fur seals, and thither the seal-hunters repair every season, for the purpose of capturing the much-prized skins of the Magellan seals. The fishing commences about the mouth of July, and lasts until February of the following year, that is to say, for about six months out of the twelve. The fishing is carried on principally by American owned vessels, and also by vessels the property of Chilians on the West Coast, and by some the property of citizens of the Argentine Republic and the Banda Oriental.

The principal station for the sealers is the small settlement of Punta Arenas, or Sandy Point, in the Straits of Magellan. This place was formerly used by the Chilian Government as a convict station, to which military convicts were transported; but a few years since a mutiny broke out amongst the convicts, and their guards, a small detachment of Chilian troops, having fraternised with them, the little settlement was in a state of anarchy, which lasted until all the intoxicants in the place had been consumed (a period of about three days), when, after setting fire to the town, the mutineers started off towards the Argentine Republic, which, however, very few of them reached, in consequence of quarrels having broken out amongst themselves, and also on account of the hostility of some Patagonian Indians, through whose camps they had to pass. Six or seven of the mutineers, who had escaped in a boat, were captured and brought back to the settlement, and were tried by Court Martial and shot in the Plaza. Since this occurrence Sandy Point has ceased to be used as a penal settlement, and it has become the headquarters of the sealers. Twice during the year the little town is a scene of unwonted activity: once during the time the sealing fleet is fitting out and preparing to proceed to the Rookeries, and again upon the return of the sealers. Occasionally it happens that a sealer makes an exceptionally good haul at the commencement of the season, and fills up before the usual time, in which case she runs down to the settlement, and either sells the skins to the merchants there, or tranships them to the first Pacific mail boat or German steamer which calls at Punta Arenas, homeward bound, returning to her sealing ground in time to secure a further take before the close of the season. An exceptionally good take for a season is 10,000 skins; this, at an average rate of £2 15*s.* per skin, gives a gross return of £27,500, and shows how profitable an undertaking fur-seal fishing is where attended with success; but it is quite a lottery, and the only way to secure success is unwearying vigilance and a determination never to let a chance escape. Even then, it is by no means certain, and it often happens that the most active vigilant crew come off worse than those who may have lighted by chance upon a well-stocked rookery.

The seal rookeries are marked upon the charts, and, as a rule, the seals return year after year to the same rookery; but occasionally they take up fresh ground, and sometimes the most prolific hunting ground is that which has perhaps been regarded as barren by the sealers for years past. In the early part of 1880 I came through the western channels of Patagonia, having entered the straits at Tres Montes. On my passage down, I had occasion to send a boat away to examine the passage between a group of barren rocks, called the Covadonga Group, and the island to the westward, that passage being the channel I was recommended by the sailing directions to use. On reaching the group, my people found that it was occupied by a dense seal rookery, of some thousands of seals. As the boat approached, one fine patriarchal old seal gave the signal, and all the seals took to the water, the old dog seal following them very leisurely, and in a most dignified manner, taking a look before doing so, to see that all his subjects were in safety, and apparently determined not to compromise his dignity by any undue haste. When the boat had passed them they returned, the old dog-seal taking the lead this time, and again taking up his position on the highest point of the rock. The next day I anchored in a small harbour, and during the afternoon a sealing schooner, belonging to Monte Video, came in and anchored. They sent their boat alongside my ship, and informed me that they were in want of bread and flour. These I supplied them with, and told them of the rookery I had passed on the previous day. The master of the sealer was a Greek, and apparently a most unfit man for a sealer, for I afterwards learnt that he had not taken advantage of the information we had given him, and that his take for the whole season was only 750 skins. I subsequently met an American schooner, the *Golden West* and she went up to the Covadanga Group, acting upon our information, and filled right up there with very fine skins.

The western channels between Patagonia and the islands immediately marked by the Pacific Ocean, are studded with rocky islets the home of fur seal; during the season it is sojourning in those waters.

Let us trace the *modus operandi* of the sealer from the date when, the defects of the previous cruise made good, he is lying waiting to take in his stores and proceed to his sealing ground. One of the principal matters of business to be arranged, is the purchase of his stores and provisions, and this is done in the following way. There are certain traders in Sandy Point who supply all the needful stores on credit, to be paid for in skins on the termination of the voyage, and with few exceptions, the bargains struck are greatly in favour of the trader. With the usual improvidence of sailors, the seal-hunter, only too glad to put off the evil day, when the stores upon which he is to subsist for months have to be paid for, is willing to sign any agreement, and consequently the wily trader generally manages to get the sealer into his own hands, very much upon the truck system formerly pursued in our own manufacturing districts. I am bound to say, however, that this applies almost entirely to the native (that is to say, the Chilian or Argentine sealers), for the 'cuter American sealer is not so easily got over, and, as a rule, makes a fairer bargain. The stores, consisting of bread, flour, tea, coffee, sugar, beef, and pork, having been sent aboard, not forgetting a supply of Matte, the Paraguagan tea, and the great consoler of the South American, having been shipped, and all preliminaries as to the disposal of the expected take of furs concluded, the sealer proceeds to his grounds; there are two articles, however, which I have omitted, and which are essential, viz., a quantity of salt with which to preserve the skins, and barrels in which to stow them for shipment, and so fully equipped, the sealer takes his leave of the settlement. The weather to the eastward of Port Famine is more settled than that generally encountered to the westward, where rain falls in torrents for nine months out of the year. Violent squalls, locally called "woolly-wahs" sweep through the gullies, and great care and caution have to be exercised in the navigation of the small vessels engaged in this hazardous and precarious business. An accident, such as the loss of a spar, may be fatal to the enterprise, as it would necessitate the return of the sealer to the settlement, causing thereby much loss of valuable time, and allowing other vessels to have the pick of the best rookeries. Arrived upon their sealing grounds, the schooner selects a rookery upon which the seals are expected to congregate, and there detaches a portion of her crew with about three months' provisions, for their subsistence until the vessel shall return at the end of the season to take them off, together with the take of furs they have secured. The vessel then cruizes about in the channels, with a roving commission, picking up large or small quantities of seals as they may meet with them. It is difficult to imagine a more dreary and monotonous life than that passed by the men on the outlying rock, during three or four months of an almost Antarctic winter, exposed to severe cold, and the deluge of rain which prevails in these latitudes.

There is one danger to which the Patagonian seal-hunter is always exposed, and that is, from the canoe Indians, a miserable, barbarous race, probably the lowest in the human scale ; these savages are treacherous and cowardly, and when they see their chance, are most dangerous enemies, and when in overwhelming numbers do not hesitate to attack and murder the sealing crews, looting the vessels when they have a chance. They have been accused of cannibalism, but of this I have no proof. The canoes are generally manned, and, to be accurate, womaned by an entire family, consisting of grandfather and grandmother, father, mother, and children, two or three dogs of the purest mongrel breed imaginable, and half a dozen sea-gulls. The dogs and the gulls being trained to dive from the canoe and catch fish. On my passage down the western channels, I met several canoes of Indians, whom I supplied with biscuit and tobacco, receiving from them some of their dogs and a couple of the sea-gulls ; one of the latter flew away in a few days, but the second remained with me for a considerable time, and became quite domesticated, fraternising with my collie dog, who was a good deal puzzled by it at first. The maternal instinct of the seal is infinitely superior to that of the average Canoe Indian mother, as shown by the fact that I concluded a treaty with one of the latter for the cession of her infant in exchange for a very battered and much damaged umbrella, and I only evaded my part of the contract by giving up the umbrella to get rid of her, infant and all. The maternal instinct of the seal to which I have referred, is one of its most notable characteristics; the mother nurses and suckles her infant with the most assiduous care, and if harm befal it, displays the utmost sorrow and distress. The father likewise is keenly alive to his parental duties until the baby seal reaches something approaching to years of discretion.

But to return to our seal-hunters on the rock; the season is approaching its conclusion, the young pups have taken naturally to the water, the old fur seals are all killed off, or, grown wary, have migrated to other rocks, the skins are all salted and ready to be shipped on board the schooner, whose arrival is eagerly waited for. Sometimes owing to the boisterous weather, it is impossible for her to effect communication for days or even weeks with the men on the rock, and she has to cruise about until a favourable opportunity arrives, when that does occur, no time is lost in shipping the proceeds of the season, and then, with her hold more or less well loaded, she turns her head towards Sandy Point. Upon her arrival there, there is much to be done, the skins have to be packed in casks for shipment to the first homeward bound steamer. Everything and everybody is thoroughly active, and the little settlement again wakens up to abnormal life and energy. Accounts have to be squared up with the merchant who has a prior claim upon the take for goods supplied, and it generally takes several days to adjust accounts, and before each man receives his share of his hard earned gains.

Such is a very brief account of the fur-seal fishery of Southern Patagonia, and it only remains for me to make a few further remarks as to the modes of killing the seals, their habits, and the prospects of their continuance in the waters to which we have principally referred.

The system of netting seals is not in use in Magellan, they are either shot or clubbed by the sealers, the head being the vulnerable part, the hunter strikes them with a club just over the nose, and so despatches them; this method of killing them is preferred on account of its more rapid effect.

The dog seal is occasionally a dangerous enemy to meet, and serious, sometimes fatal injuries have been inflicted by it upon rash or unwary hunters. The affection of seals to their young I have already referred to, and I have been told by veteran hunters, that it has been frequently difficult for them to restrain the emotions of pity evoked by the piteous sorrow displayed by the dam for its cub, and the pup seal for its parent. Just prior to the period of mating, the male and bachelor seals arrive at their quarters, and await the arrival of the females; when these latter do arrive the seals busily employ themselves in pairing off with the wives of their choice; sometimes it happens that two males fix upon the same female, and the result is a most sanguinary encounter, the female invariably complacently accepting the victor for whose success she has waited, without evincing any emotion whatever.

Captain Fanning, one of the noted sealing masters in early times, distinguished the different ages and sexes of the fur-seal as follows:—Full aged males, called wigs; the females, clapmatches; those not quite so old, bulls; all the half-grown of both sexes, yearlings; the young of nearly a year old, called grays, or silvered pups, and before their coats are changed to this shade, called black pups. The full-grown female, or clapmatche, averages fully one-half the length of the largest males or wigs, and the colour of the greater portion of them is silver-grey, while that of the wigs is dark brown; both old and young are of lighter shade underneath. The layer of fat, or blubber, between the skin and the flesh, may average one and a half inch in thickness, according to the time the animal has been on shore, it being very fat when the season begins, and very lean when the season is over, which changes the animal's appearance from its former robust condition. When in full flesh, the adult female weighs about 85 lbs.

It is very rarely that the female has more than one pup, and the time of gestation is about ten months. The time of bringing forth, or the pupping season, on the coast of California, is from May to August, and on the coast of Patagonia, and the latitudes near Cape Horn, from October to March.

The flesh of the pup-seal when six weeks old or more, is esteemed by the seal-hunters as equal to the best mutton, if properly cooked. The flesh of the yearling seal is somewhat darker than beef, it is juicy and tender, but lacks the sweetness and flavour of beef, and is less firm and nutritious. I am indebted to a work on Marine Mammalia, by Captain Scammon, of the U.S. Revenue Marine, for many of the foregoing facts. And also to the Canadian Commissioner at this Exhibition, for some information as to the seal fisheries on the Canadian coast.

There can be no doubt but that in consequence of the great destruction of seals within the past fifty years, seals are getting both scarce and wary. Sealing is now being carried on by steam-vessels, manned by large crews, and the effect of this is, that two trips can now be made in place of one formerly made by the sailing-vessels. Some more stringent State supervision of the seal-fisheries would doubtless result, in course of time, in increased numbers of seals, and consequently to the benefit of the hunters themselves and the public at large. The life of the seal-hunter is one of extraordinary hardship; he lives in close, dirty quarters, saturated and greasy with the oil; his food is of the coarsest; he can never call an hour his own, should he have a successful season, and find seals plentiful, after he has filled the hold of his vessel, he stows the skins in his own quarters, sleeping and living amongst them with admirable disregard of his own comfort. He seldom changes his clothes from the commencement to the termination of the season. When he does indulge in the luxury of a clean garment, he puts it on over the dirty one, and is quite content when it likewise gets saturated with the all pervading oil.

The greatest hardship to be endured, however, by the seal-hunter, is when, in addition to the privations and difficulties inseparably connected with his occupation, he fails to secure skins sufficient to pay some of the demands of the store dealer; he knows then, that after a period of poverty and privation, he will start the following season heavily handicapped by the debts of the previous cruise.

There is much that I have left unsaid upon this interesting subject, but I must conclude by thanking you for the patient and attentive hearing you have granted me.

DISCUSSION.

Mr. **Ridley** (acting Commissioner for Newfoundland) said he had been much interested in the admirable paper just read, and he thought Captain Temple had exhausted the subject as far as it was possible for any one to do, but he might take leave to supply some omissions he had made with regard to the fisheries on the North Atlantic, particularly those of Newfoundland, with which, perhaps, not being familiar, he had not dealt to any extent. The seal fisheries of Newfoundland were carried on on a large scale, some 10,000 men employed in them. They were formerly carried on by sailing vessels to the number of 400, but steam had now been introduced, and the number of vessels was reduced to about thirty, but the same number of men were employed in twenty-five steamers. These vessels left Newfoundland, on the 10th March, to which time they were limited by Act of Parliament, in order that they might not capture the young seals before they were sufficiently grown. They proceeded in search of the young seals which were, as a rule, met with from the 17th to the 20th. When they were born they were about 10lbs. in weight, but in the space of three weeks they attained a weight of 45lbs. to 50lbs.; the seals had their young on floes of ice about 300 or 400 miles from St. Johns. They were killed by a blow on the head—and then sculped, as it was called—that is opened out without barbarity, which he was afraid some people supposed to be the case, the fat and skin only being taken on board the steamers. The first trip generally occupied three weeks or a month, and he had known vessels in that space of time capture as many as 42,000 young seals, worth some £25,000. Having returned and deposited the pelts, they then went out on a second trip to catch the old seals, if possible, but this was much more difficult, as they were very astute; they popped their heads up, and if they saw any danger about they soon popped them back again and escaped, and it required skilful riflemen, as Newfoundland sealers generally are, to pot them off. The whole season occupied about two months.

The catch of 1883 had been a fairly prosperous one, the total exceeding 400,000. He had much pleasure in moving a hearty vote of thanks to Captain Temple for his able and exhaustive paper.

Major SEWELL-GANA (Chilian Commissioner), in seconding the motion, remarked that in consequence of the great development of seal fisheries in and about the Straits of Magellan, the Chilian Government had lately appointed a Commission to study the question, and they were about to introduce a law to enforce a close time, and to extend to that region the regulations of the civil code with regard to fishing.

Mr. MARTIN said he should like to add a few words on the subject of the paper. Captain Temple had stated that seals were to be found more or less all over the globe, but he had only described in detail the Canadian and Patagonian fisheries, the latter of which he referred to as the South Sea fisheries, but he thought Captain Temple would agree with him that they might be better localised as the Cape Horn fisheries. He had omitted to refer to the Lobos Island fisheries off the river Plate, which yielded 10,000 to 14,000 skins per annum. Then there were the South Sea fisheries, which he might call the South Shetland Island fisheries, which were of a more speculative character, for he had known one vessel come back from those islands with a load of one skin. On the other hand, they sometimes got large quantities. One point he wished to notice was that Captain Temple seemed to fear a deficiency in the supply of seals, but he thought there was not much danger of that, for England and Norway had now entered a compact to regulate the Greenland fisheries; the English boats were not to leave for the Greenland fisheries before a certain date, and on the introduction of this law a gunboat was sent up to the fisheries to see that the regulations were adhered to. About three seasons ago, if he recollected rightly, the large quantity spoken of by Captain Temple was far exceeded, for Newfoundland and Greenland together yielded 500,000 skins. Again there was a most important fishery of fur seals on the North Pacific, on the islands of St. Paul and St. George in the Alaska Territory. A few years ago that country belonged to Russia, but it was ceded to America, and the American Government leased it to the Alaska Commercial Company, who had the sole right of fishing there, paying to the American Government a certain rent and a royalty on each skin; the quantity was strictly limited to 100,000 skins a year. Again, there was the Copper Island fisheries, which belonged to Russian America still, and was nearly to the North of Japan, that yielded between 20,000 and 30,000 skins annually, and there were also the Japan seal fisheries, the produce of which varied very considerably, say from 5000 to 20,000 skins. On the whole, therefore, he thought there was no likelihood of the supply falling short.

The vote of thanks having been carried unanimously,

Captain TEMPLE, in reply, said he was quite aware that he had not thrashed out the whole subject, and he had not attempted to deal with any seal fisheries, except those which he had actual experience of, trusting that some gentleman, who knew the subject well, would come forward and add to the information he had given, as Mr. Martin had been kind enough to do. He was glad to hear from Major Sewell-Gana, the Chilian Commissioner, that Chili had at last recognised the fact that it was necessary to have a close season, for when he was in the Straits of Magellan, three years ago, the scarcity of seals was the subject of universal complaint. It was quite clear, however, that Chili, who was making great progress in every way, had recognised the evil, and had now taken steps to protect this most important industry.

Mr. BIRKBECK, M.P., then moved a vote of thanks to Sir John Rose, for presiding. Although he might be somewhat disappointed at seeing so small an audience, the Executive Committee felt very strongly the great importance of these discussions. The object of the Committee was that all the papers read at these Conferences, and the discussions, whether short or long, should be fully reported, and they would appear in the official report, at the conclusion of the Exhibition. Many of the Foreign Commissioners had told him how valuable these discussions would be in an international point of view. The paper now read was one of very great interest to him, though Captain Temple had not referred to the seal fisheries, where he (Mr. Birkbeck) had once spent a whole summer, namely, in Spitzbergen. There the seals were not hunted so much for the sake of their fur, being a much larger kind, from eight to ten or twelve feet long, and they were captured for the sake of the oil. He could quite corroborate what had been said as to the great difficulty of catching these seals from their exceeding shyness. At Spitzbergen the only way to take them was by shooting them with a rifle from a boat, and they were always found in ice-bergs, in flow ice. The great difficulty was that there was always a slight swell, and while you were aiming at the seal, probably, the boat was rising with the swell whilst the ice, with the seal on it was very likely falling at the same time; if you did not shoot the seal through the brain you might row as hard as you could, but he was certain to be lost.

Mr. EARLL (United States Commissioner), seconded the motion. Sir John Rose was very familiar to them on the other side of the water, and they all appreciated his efforts in connection with the fisheries of Canada. Whilst he held public office there he was continually mindful of the fishing interests of Canada, and did everything in his power to promote them. He had also taken an interest in the seal fisheries of that region. With regard to the subject referred to by Mr. Martin, as to the seal fisheries belonging to the United States, and leased to the Alaska Commercial Company, the islands there though small were literally covered with seals during certain portions of the year. They came in in enormous quantities, and were then surrounded by the natives, who, in preference to killing them with the gun, as described by Mr. Birkbeck, drove them several miles inland by means of bones which they used as clappers until they got into some convenient place called a butchering ground. They then separated them into what the fishermen called small pod, a pod being a sufficient number to be disposed of in one day. They were despatched by clubs and skinned, and the natives were so expert in taking off the skin that several were stripped in the space of one minute. Those skins were carefully rolled together, and sent off to be prepared for the market. As stated by Mr. Martin, the fisheries were limited to 100,000 annually, that being considered a fair number to prevent the seals being exhausted.

The vote of thanks having been carried,

The CHAIRMAN, in reply, said it was a very easy task which he had undertaken that day; the success of the Exhibition did not depend upon those who gave a few minutes to it to take the chair, it was due mainly to the untiring energy and great administrative ability of Mr. Birkbeck. Those who had inspired this Exhibition, and carried it out so far to a successful issue, deserved the thanks of the nation at large, and when these papers were printed and published and read by millions, as he hoped they would be, it must produce inestimable benefits on the world at large.

STORM WARNINGS.

BY

R. H. SCOTT, M.A., F.R.S.,

SECRETARY TO THE METEOROLOGICAL COUNCIL.

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CONFERENCE ON MONDAY, JULY 16, 1883.

Mr. J. K. LAUGHTON, M.A., President of the Meteorological Society, in the Chair.

STORM WARNINGS.

IT sounds like a truism to say that almost every trade, every occupation in life, depends more or less on the weather, but surely that of the seaman or fisherman is more seriously influenced by it than any other. Accordingly great interest attaches to the efforts which are now made in all civilized countries to convey to their seafaring population any intelligence which may be of service to it in its laborious and perilous calling.

With the view of exhibiting what is being done in this direction in various parts of the world, the International Meteorological Committee, at its recent meeting at Copenhagen, resolved, on the invitation of the Executive Committee here, to invite all Meteorological Offices possessing a storm-warning organization, to send to London specimens or models of the methods and apparatus employed by them in the service.

The result has been that for Europe, Denmark, Germany, Great Britain and Ireland, Holland, Portugal, and Russia are represented, while from the United States the Chief Signal Office at Washington has sent a full display of its appliances, which ought to put several European Governments to shame.

The most prominent exhibitors in the way of models, next to the United States, are Germany and Holland, of whose apparatus I have exhibited specimens on the table. I shall explain these subsequently.

The first idea of conveying intelligence of storms by the electric telegraph, appears to have occurred to Mr. Redfield, known as the first discoverer of the Law of Storms, in the year 1847. He was an American, and various attempts were made to carry this idea into effect at the other side of the Atlantic, before the war of 1861 put, for a time, a stop to all such progress.

In Europe, Leverrier was the first in the field, and in February, 1855, he obtained the Emperor's sanction for the creation of an extensive organization for the purpose of distributing weather intelligence over the countries taking part in the scheme.

The fact that the well-known Balaclava storm of November 14, 1854, had travelled along southern Europe before it burst upon the allied fleets on the Crimean coast, was that which decided Leverrier on carrying out the experiment, but it was not until five years later, in the spring of 1860, that he felt himself in a position to invite other countries to join in the scheme.

His letter to Sir G. Airy, of that date, contains the following expressions, which now, at the end of three and twenty years, represent fairly enough the conditions of storm warning.

"The ultimate result of the organisation which we are establishing should be to announce a storm as soon as it appears at any point in Europe, to follow it on its course by means of the telegraph, and to give timely notice of it to the coasts which it may reach."

My audience will see that this programme contains no idea of prophecy, nothing but a statement that a telegraphic message would travel faster than a storm, and that warnings of the storm could therefore be sent. In this country the idea of storm warnings had been ventilated before 1860, for the British Association at their Aberdeen meeting in the previous year, under the presidency of the late Prince Consort, had passed a resolution in favour of their introduction. A month after the meeting the loss of the *Royal Charter* on the north coast of Anglesea attracted universal attention, and from the circumstances of that case the public drew the hasty conclusion that no storm could ever come on without giving timely indication of its approach. Before I have done I shall hope to show how unsafe such a generalization was and is.

Early in 1861 the first tentative warning was sent out in this country, and by the spring of 1862 Admiral Fitz-Roy's system was definitely established. The admiral, however, as is frequently the case with enthusiasts, tried to run before he could walk, and issued warnings to cover an interval of three days, a period now universally admitted to be too long, but, with this exception, the mode of conveying intelligence, devised by him at the outset, was so sound and practical that it has met with general acceptance, in Europe at least.

The basis of his signal system was the employment of solid figures, what are called, mathematically, solids of revolution, to convey his messages. The use of flags was objectionable, as these are employed for many other purposes besides storm signalling. Of such solids there are three simple forms, the sphere, or *ball*, the cylinder, or *drum*, and the *cone*. If any of these are hoisted on a flagstaff they will always present the same form to the eye at a distance, no matter how they are blown about. The ball will be a circle, the drum a rectangle, and the cone a triangle.

Of these forms the ball was already pre-engaged, at least in our harbours, e.g., for conveying tidal signals as to the height of water on a bar. Admiral FitzRoy, however, adopted the two others.

With him, the cone, point upwards, indicated a gale from a northern point; reversed, it showed that the gale was to be expected from a southern quarter, and the drum announced "dangerous winds from opposite quarters successively."

In this country the use of the drum has been abandoned, as it was found that little practical advantage could be gained from it. Our area is so small that we generally have only time to announce the existence of a storm, without attempting to indicate its probable violence—a quality only to be learnt from reports of its effects.

The cone and drum, in various combinations, are the signals used throughout Europe generally, except in Holland, and the drum is employed to emphasize the cone, to show when a very severe storm has been already reported from the outlying stations. My audience will remember that for such information ours are the outlying stations for Central Europe and North Germany at least, the storms striking the coast of Ireland or Scotland first.

The Dutch system is on a totally different plan, and in order to explain it I must enter into a brief account of some simple meteorological principles.

I suppose that all of my hearers have at least learnt from the daily reports in the newspapers that storms do not depend on the actual height of the barometer at any time at any one station, but on the difference between the simultaneous readings at adjacent stations, on what is called *the gradient*, the difference between barometrical readings over a given distance, say fifty miles.

This will best be understood by reference to a diagram of one of our severe storms. The lines on such a diagram are called isobars, and they represent lines of equal barometrical readings. Where such lines are closely packed together there are great differences in barometrical readings for the unit of distance, that is, there are high gradients, and consequently strong winds. Where the isobars are far apart there is little difference in readings for the unit of distance, and the winds are light.

In every case also the wind blows so as to have the lowest barometer on its left hand side, in this hemisphere, and its force is more or less proportional to the gradients.

It is on this principle that the Dutch mode of weather signalling is based, and this is essentially not a mode of storm warning. The inventor of the apparatus, called the Aeroklinoscope, is Professor Buys Ballot, of Utrecht, and he has formulated the principle which I have mentioned, into what is known as his Law, which for the northern hemisphere runs thus.

"Stand with your back to the wind and the barometer will be lower on your left hand than on your right."

The apparatus consists of a bar or cross piece like a ship's yard, hoisted on a mast, which can be swung round so as to point in any direction, and can be peaked to any reasonable extent.

It is erected at the ports in Holland, and is set every day according to the weather reports, and according to the barometer readings taken that morning over the kingdom.

It is set so as to point from the highest to the lowest barometer readings, and the angle at which it is set indicates the amount of difference between those readings.

Accordingly if the seaman looks at the apparatus he sees from what point the wind will blow during the day, and can form some idea of its probable force.

It will be seen therefore that the system is intended for daily, not only for occasional use. The idea is theoretically good, but practically it is not easy, if you are at a distance, to make out which end of the cross-bar is nearest to you, or whether you are in front or at the back of the apparatus. To aid you the two ends of the bar are marked differently, and the two sides coloured differently; but it is not easy to make out the colours at a distance.

In the United States the system is different from anything we have in Europe. There flags are used, a red flag with black square or a red lamp at night, indicating dangerous winds from any direction, and a white flag with black centre, or a white lamp at night, indicating dangerous *off shore* winds, i.e., winds from north and west, and a ball is hoisted to show that storm warning of some sort or other has been issued. I may say, *en passant*, that it seems a little remarkable that storm signals are hoisted at 111 stations only over the whole United States, while we in these islands have nearly 140 for a much smaller area.

Having thus said something about the apparatus employed to communicate storm warnings, let me now proceed to explain what meteorologists are able to convey by its use.

I suppose that all of my hearers have read enough of late years about depressions, which always bring bad weather, storms in winter and rain in summer. Now I do not mean to say that all our storms are due to depressions, but by far the greater part of them are so, and for the purposes of this lecture I shall only treat of such storms.

What, then, is a depression, or a cyclonic disturbance? it is a portion of the atmosphere in motion more or less approximately circular, round a central point. At this central point the barometer is lowest, and, in this hemisphere, the air is moving in the direction against watch hands, or in accordance with the Buys Ballot's law just explained, and the clouds and weather are distributed according to known laws, which have been explained by various authors.

Now for the purposes of storm warning, in its simplest conception, we have only to recognise the existence of these depressions, and you must take it on my word that they generally move over the earth's surface, and in these latitudes usually advance from west to east.

The rate of advance varies from, say, ten miles an hour to as much as sixty or seventy miles an hour, a rate which has been proved to have existed in certain storms crossing the North Sea.

When therefore one of these depressions appears on our coasts, and not till then, can we venture to announce its proximity by our warnings.

We can only learn the fact of its existence from our reporting stations, and these are represented on the map which I exhibit. A glance at this will show how "few and far between" these are on the west coasts of Ireland and Scotland.

These are the most important districts in Europe for gaining early intelligence of weather changes, but in the first instance telegraphic communication is only very scantily developed in such wild regions, and in the second place the habitable spots are all in sheltered bays, where the true force of the wind is not felt, owing to the fact that few ordinary houses could bear the brunt of an Atlantic winter gale. The observers therefore are unable to send us up perfectly true reports of the direction and force of the wind.

A great deal is said about our obtaining reports from Newfoundland, or the United States of America, the Azores, the Faroes and Iceland, and lastly from moored signal ships. Reports from the other side of the Atlantic would certainly be valuable if we could obtain them cheaply, but the difficulty would be in knowing how to make use of them, for though storms do cross the Atlantic from shore to shore, they change their character *en route*, some increasing and others dying out, so that from the reports from America alone, we cannot foresee which storm out of several starting successively from the States, or Canada, will reach us.

My hearers will of course expect to hear something of the *New York Herald* warnings, which we owe to the well-known public spirit and liberality of Mr. Bennett, and which appear so frequently in the newspapers. It is however not possible to discuss these communications here, because the mode of preparation of the warnings has never been published. In no instance have the precise facts which led to the issue of one of these warnings been communicated, at least to our office, so that we could form a judgment as to whether the same data would have induced us to issue a warning.

As to the Azores or the Faroes, no cable has yet been laid to either group of islands, and it does not seem likely that any will soon be in existence; for the expense of an ocean cable is so great, that there is no chance of its being a paying speculation unless it holds out prospects of considerable commercial utility. These cannot be put forward in either of the cases cited, for no great trade exists on those lines. To give an idea of the amount of money required to lay and maintain such a cable I may say that one project required a guarantee of international support from all the Meteorological offices of Northern Europe, the quota from this country for three daily reports being £3,000 a year, one-fifth of our annual grant from Parliament. It is therefore evident enough that for the present we must give up the immediate prospect of Atlantic island stations.

As to news from the surface of the Atlantic itself, the idea of mooring ships and connecting them by telegraphic cable with the shore, has been often mooted, and there is a plan for it in the present Exhibition, but it has never been carried into practice; and until the lighthouse authorities have established telegraphic communication with their light ships, we need not expect to establish it with a ship in mid-ocean, even if we could succeed in mooring and keeping her there.

To give an idea of the extent to which storms striking our coasts could really be predicted by means of reports from America, my friend Captain Hoffmeyer, the head of the Danish meteorological service, who has published daily weather maps of the Atlantic for the space of three and a quarter years, in a pamphlet which appeared in 1880 investigated the courses of Atlantic storms. He discussed 285 depressions in all, covering an interval of twenty-one months, and found the following percentage proportions :—

Source of Depression.	Existing in Long. 40° W.	Passing Long. 10° W.
Arctic regions	8	6
North America	44	24
Probably tropical	9	2
Arising at sea	37	16
Untraceable	2	2
	100	50

You will therefore see that only half of the disturbances which appear in mid-Atlantic live till they reach the Irish coast, and that only one quarter of the storms which visit us ever come from the States or could possibly have been telegraphed from thence.

The large diagram which I exhibit, and which has been drawn by Dr. Köppen of the Hamburg Meteorological Office, shows the districts of maximum frequency of depressions over the Atlantic, on the average of the year. It will be seen from this that a broad belt extends from 40° N. over the eastern States and out as far as Newfoundland. If the map were extended westwards we should find this belt stretching back to the Rocky Mountains. After passing Newfoundland the belt becomes narrower and trends north-eastward, till it touches the permanent Icelandic depression, which exists in the north Atlantic during the greater part of the year. From this point it throws out an arm into Davis's Straits. The main stream, however, passes on, and on the Scandinavian coast forks, one maxima lying near the Loffodens, the other over the southern Baltic.

It is to this general direction of the mean path of depressions that we owe our prevalent south-westerly winds. If the track in our neighbourhood is from a northern point, down the North Sea, we have our northerly winds and cold weather. If it lies along the Channel or over France we have our easterly winds, such as visit us in spring.

Having thus given you some slight idea of the origin of our storms, and of the courses by which they arrive on our shores, I must now say something of the extent to which we succeed in giving timely warning of their approach to our fishermen and coasting seamen.

It must always be remembered that in order to issue perfectly correct storm warnings, we should require to know the size, shape, position and motion, in direction and rate, of an advancing depression, and also whether it is becoming deeper or the contrary; and that there is not one of these conditions of which we have a really sufficient knowledge at present, while of most of them we can have no knowledge at all till the storm has burst upon us.

The problem, which is put before us daily, is similar to one which astronomers would at once recognise as one impossible of solution, and that is to determine the elements of a comet's path from a single observation taken, say, in a brief clear interval on a cloudy night. The first glimpse we get of a storm must suffice for us to issue our warnings. It is therefore evident that for our own exposed western and north-western coasts we can but rarely issue timely warning; but, fortunately, these iron-bound shores are not frequented by an amount of coasting craft at all commensurate with that navigating the comparatively calmer waters of the two Channels and the North Sea.

The results of the warning to our own coasts have been printed for many years, at first as a Parliamentary Paper, and latterly in our own Reports; and the following Table gives a summary of the figures for the whole period:—

—	Warnings justified.		Warnings not justified.	Warnings.		Warnings issued in error.
	By Gales.	By strong winds.		Late.	Partially late.	
1870–75 .	47·6	26·8	18·4	1·5	3·8	1·9
1876–81 .	56·4	23·5	15·8	0·8	3·1	0·3
Average .	52·0	25·1	17·1	1·2	3·5	1·1
1882 . .	61·4	21·1	14·9	0·4	1·6	0·6

It will be seen that a decided improvement took place in the year 1876, coincident with the introduction of an evening telegraphic service—a step in advance which we owed to the liberality of the *Times* newspaper. The last year, 1882, shows a decided advance on the figures for the previous period.

It appears from these figures that more than half of the signals of approaching storms were fully justified. It is therefore evident that the organisation of storm warnings renders it possible to give useful intelligence to the coasts, but it need hardly be said that, for these islands, the system is rather of the "from hand to mouth" type, and that our warnings would be far more useful if they could be issued sooner, so as to render it possible for captains to get information of a coming gale before leaving port.

The table and diagram do not give any indication of the storms of which no warning was given, and of these there have been instances in every year. I fear that we cannot at present hold out hopes of being able to show a blank failure column in our yearly analysis. The instances ot such failure are not frequent, but they are sometimes serious, as some of our worst storms occasionally give very slight indications of their proximity by instrumental readings.

I have represented on the screen a recent instance of this, the storm of October 24th, 1882. You will see that the map for 6 P.M. on the evening before showed, in its barometrical indications and its wind reports, not a sign of the disturbance which lay over the west of England at 8 o'clock in the morning.

Similar instances might easily be cited, and others arising from miscalculation of the path which the storm was following, but the time would fail me were I to continue the subject further.

There is, however, one point to which I ought to allude before I have done. It may seem strange that when a storm made its appearance in the night time, like that of October 24th just cited, I should have said nothing about the possibility of receiving intimation of it by means of later, say midnight reports, and distributing the news to the coast stations at once.

The explanation of not doing so is, that though we might organise night reports, the only portion of the population who could benefit by them would be the readers of newspapers. We could send forecasts to the press at a later hour than 9 P.M., but we could not send warnings to the fishermen on the coast; and it is for them in the first instance that the warnings are meant. The local telegraph stations close at 8 P.M. at latest, and so the messages could not possibly reach the coasts before about 9 A.M. next day, when, as will be seen by the map, they would have been too late for the coasts of Devon and Cornwall.

The development of our storm-warning system is regulated mainly by the completeness of our telegraphic arrangements. If the fishing villages were all telegraphic stations, and were all open all night long, we might be able to communicate to them the fact of a storm having appeared, as soon as we ourselves had learnt it, but the nature of our communications being such as it is, we must only make the best use we can of the facilities we possess and of the funds we are able to devote to the service. If the funds were increased more telegrams could be received, more warnings issued and more work done.

It would doubtless be of interest to my hearers had I time to treat of the scientific aspects of the question of storm warning, of the observations taken, of the discussion to which they are subjected, and of the efforts we are making to improve and accelerate the service, but such a lecture would be hardly suited to a general audience, as for it I must presuppose a more intimate acquaintance with the technicalities of meteorological phraseology than can usually be expected. I must therefore only conclude with the hope that I have shown you that in most countries endeavours are made to utilise, for the benefit of the fishing and coasting population, the most recent discoveries and developments of meteorological science, and that the outcome of these efforts has been unquestionably the saving of life and property to a very large extent.

When, seventeen years ago, the issue of storm-warnings was temporarily suspended by the Government, the outcry from the fishing population was too serious to be disregarded, and the service was soon re-established.

In the course of the year 1881 the Meteorological Council addressed a circular to all their storm-warning stations in order to obtain expressions of local opinion as to the value of the warnings. The replies, 135 in number, were, with few exceptions, unanimously favourable, and showed that during the twenty-three years of its existence in the United Kingdom, the storm-warning system created by Admiral FitzRoy, and carried on successively by the Meteorological Committee and the Meteorological Council, has certainly not lost its position in the estimation of the British fishing population.

DISCUSSION.

Mr. **MILNE HOME** congratulated the Executive Committee on having secured the services of so able an exponent of this subject, for no one could have been selected who was better acquainted, either scientifically or practically, with storm warnings than Mr. Scott. He would not attempt to follow him in his explanation of cyclones and other storms, but would say a word as to the extreme value of these warnings to his countrymen in Scotland, especially the fishermen who inhabited the part of the coast where he resided. In October, 1881, there was a tremendous hurricane, which destroyed the whole fleet of fishing vessels belonging to Eyemouth, and the destruction both of life and property was so great that the sympathies of the whole country were aroused, and a fund of £50,000 was raised to maintain the families which had been left destitute. It was certainly to be regretted that these forecasts of approaching storms were not more generally known along the coast, but Mr. Scott had explained the difficulty. About twenty years ago he was the means of establishing a large barometer at Eyemouth, and explaining the conclusions to be drawn from it; the fishermen of the town generally availed themselves of it, but unfortunately at the time this great gale occurred there was one young fisherman who disregarded the warning which induced the older men to stay at home, and he put out in his boat; the others felt ashamed not to follow him, and the consequence was that nearly one hundred fishing boats put off into the North Sea, and met with the disaster which he had mentioned. He believed that barometers were now generally established in fishing villages, but it was much to be regretted that there were so few stations on the western coast for affording intimation of storms. Mr. Scott had mentioned there was no station between Stornoway and Ardrossan, a distance of about two hundred miles. Ben Nevis was the highest mountain in Great Britain, and the Scottish Meteorological Society were now endeavouring to raise a fund to establish a permanent observatory on that important point. He was happy to say that out of £5000 necessary, £4000 had already been raised, he having obtained within the last few days a considerable subscription from the Corporation of London, and he trusted this example would be of service in obtaining the remainder of the sum. He was aware of the proposal to establish moored ships in the Atlantic from which signals might be sent, but, as his brother, Admiral Milne, had pointed out, it would be practically impossible to moor a vessel with an iron cable in 1200 fathoms. There was however a rock called Rockall, about two hundred miles from the west coast of Ireland, a most dangerous rock, upon which, if a lighthouse were erected, it would be of service, not only in preventing shipwreck, but also in forwarding signals.

Mr. SHEWARD concurred in the suggestion just made. Not long ago a most destructive storm visited London, of which no warning whatever had been given, which he attributed to the absence of signal stations farther west. If earlier signals could be obtained from the Atlantic an enormous amount of life and property might be saved. He was there not long ago, and noticed that about ten miles from the west coast of Ireland there was a sort of table land where the water was only 900 ft. in depth, and it appeared to him it would not be difficult to moor a vessel there.

Mr. BIRKBECK, M.P., proposed a vote of thanks to Mr. Scott for his admirable paper, which would be, when published, of the greatest value, not only to the fishing, but also to the shipping interest. Living on the east coast of England, he knew full well how often fishermen were prevented going to sea in the face of an impending storm by these warnings from the Meteorological Office, and he could only hope that the system would be very much extended.

Mr. ABERCROMBIE, in seconding the motion, said there was one point to which Mr. Scott had not done justice, and that was the enormous amount of work which he himself, in an unobtrusive way, had performed in the Meteorological Office, and the researches in which he was continually engaged with a view of increasing the already large number—about 83 per cent.—of successful predictions. There was no doubt that though this success was very gratifying it would continue to increase from year to year.

The CHAIRMAN, in putting the motion, said he could speak from personal knowledge of the great care, energy, and industry of the officials in the Meteorological Office. The difficulties they had to contend with were very great, owing mainly to the financial question, which was, from the peculiar circumstances, almost impossible of solution. It was practically impossible, on financial grounds, to keep telegraph offices open all over the country day and night, by which means alone could the desired end be attained, and it was impossible for the same reason to establish a telegraph office at every fishing station, or along the west coast of Ireland. There was one way in which the present system might be supplemented and strengthened, and that had been referred to by Mr. Milne Home. For two years past observations had been carried out by the Scottish Meteorological Society on the top of Ben Nevis, and they were endeavouring to make the system permanent. It was not known to all present, perhaps, that the storm warnings in the air were somewhat earlier in the upper regions of the atmosphere than at the surface; the disturbance occasioned by a cyclone was to some extent tilted forwards, and the upper part travelled considerably in advance of the lower. From this cause an observatory on Ben Nevis would be equivalent to one several degrees farther westward; and he hoped before many years that similar observations would be established on several other high peaks, in Cumberland for instance, or Snowdon or some adjacent hill, and on one of the highest "tors" in Dartmoor. The expense was not absolutely prohibitive; as they had heard £5000 was sufficient, and that might be given either by united contributions, or by some rich man who felt interested in the subject. At South Kensington they could see what private munificence could achieve for public objects; there were magnificent collections of pictures and works of art given to the country by private individuals, and it might be hoped that when the utility of upper stations, such as that on Ben Nevis, was once established, men of wealth would come forward to support similar establishments in other parts of the country. In connection with the Fisheries Exhibition at any rate it behoved them all to remember that though fish formed a very useful article of food, they were very often, in the words of the poet, "lives of men."

The motion having been carried unanimously,

Mr. SCOTT, having thanked the meeting, said he was very glad to hear of the good prospects of the Ben Nevis observatory, but he had not time, seeing there was another conference to be held at four o'clock, to go into some of the questions which had been raised, such as the formation of a station at Rockall. He would conclude by proposing a vote of thanks to the Chairman.

Mr. JOHN S. DYASON, F.R.G.S., seconded the motion, which was carried unanimously, and the conference adjourned.

SAVING LIFE AT SEA.

BY

RICHARD ROPER.

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SAVING LIFE AT SEA.

THE number of ships, the aggregate armament, steam power, tonnage, crews, and equipment throughout, that comprise the Royal Navy of the United Kingdom; the number of vessels, and the aggregate power, tonnage, and crews of the English Mercantile Marine, the number of persons it conveys, and the quantities and values of the freights and cargoes it carries to and from all parts of the globe, combine to place England at the head of the maritime nations of the world. The feeling of national pride that this supremacy naturally inspires, is tempered by a sense of humiliation because of wanton waste of human life in connection with it; of culpable neglect on the part of shipowners in failing to supply, and of the responsible authorities in failing to enforce, such provisions and conditions for saving life at sea, in certain emergencies, as passengers and crews may reasonably claim, and as Government authority alone can prescribe and enforce.

The subject of saving endangered life at sea is one that enlists the sympathies of men of all classes and conditions; it commands great and ever-growing interest and attention; its discussion, like "a good maxim, can never be out of place;" reference to the subject in the permanent records of "The Great International Fisheries Exhibition, 1883" is deemed fit and appropriate, in its relation to the important maritime industry that the Exhibition was organised and carried out to promote. The subject has its bearing on the Fisheries, if not very direct or apparent upon actual fishing craft, certainly upon the vessels that bear home the harvest of the sea from the fishing grounds. In any case, discovery and application of the most trustworthy means of saving life and of reducing the perils of the sea to a minimum, must be an object of universal desire.

The subject offers three divisions for discussion :—

I. The need for extended and improved means for saving life at sea when the ship fails to provide a place of safety.

II. The distinctive qualities and capabilities that such improved means should possess. And,

III. The mode and authority by which such improved means should be applied.

First, then, as to the need for extended and improved means for saving life at sea when the ship fails to afford a place of safety. There is, alas ! a bewildering abundance of heartrending evidence in proof of this need. Narratives of disasters at sea, in which indescribable sufferings and appalling loss of life have been endured and sustained—calamities that have sent their successive quivering thrills of pain throughout the civilised world from its centre to its circumference, rush unwelcome into mind. Even a selection from what may be regarded as typical cases that have occurred within the lifetime of the present generation, even within comparatively few years past, would require more space than can be spared for a bare catalogue of names of ships, and the dates and localities of the disasters. Amongst these would be the *Atlantic*, *Kent*, *President*, *London*, *Royal Charter*, *Schiller*, *Deutschland*, *Northfleet*, *Avalanche*, *Eurydice*, *Princess Alice*, *Waitara*, &c. In little more than the first month of the current year (1883), as many as three emigrant ships have been engulphed, and numerous other appalling disasters have occurred in various parts of the ocean's domain that have proved conclusively an urgent and clamorous need for extended and improved means for saving life. An endeavour will be made to prove, by a few illustrations, that the means provided are greatly inadequate in extent, and that even to the extent of their limited capacity these fail to warrant trust and to render service in the last extremity.

The general observation may be made, *in limine*, that in an indefinite number of instances vessels of various kinds are allowed, unquestioned and unimpeded, to cast off from quays and ports to commence their voyages or trips with freights of human beings on board, for floating whom, should their ship fail, no provision whatever is made by boats or otherwise. There is not even a pretence of such complete provision made by the owners. In the case of ocean-going steamships, and some passenger and emigrant ships, there *is* a pretence of boat accommodation for passengers in case of need, but it is a pretence, and nothing more. The rows of nicely-painted canvas-covered boats of outward-bound liners ("Jack" probably thinks them lumber and in the way), look very pretty, almost imposing, and are apt to impress with a sense of forethought and a feeling of security; but they are really, in view of possible requirements, a delusion, almost a fraud and a false pretence, and the intending passenger who trusts to such appearances can be but little wiser than the hunted ostrich that hides its head in the sand. The boats provided for ocean-going passenger and emigrant steam or sailing ships, and transports, are never sufficient in numbers and carrying capacity to float more than a fraction of the persons in the ships respectively.

It is notorious, indeed, that owners are not required to make full provision, and in case of wreck a majority of those on board must inevitably perish unless, if in mid-ocean, they are equal to a greater feat than swimming the Channel or of shooting Niagara. On the subject of insufficient boat accommodation Admiral Jasper Selwyn has said: "With regard to our passenger steamers, few people understand the discrepancy between the Board of Trade requirements and actual practice. I have been across the Atlantic several times in 6000-ton vessels, carrying actually from 1500 to 2000 passengers, capable of carrying with ease 3000 passengers. There were, probably, boats on board, which, in case anything happened to the ship, would have carried from 200 to 300 passengers, supposing all those boats had been got into the water without damage, a thing you can scarcely expect from an undisciplined crew, and still less disciplined passengers, and supposing that every precaution had been taken." * It might have been added, and "supposing wind and weather favourable, much the reverse being the prevailing condition." In further illustration of the inadequacy of boat provision, it may be mentioned that Captain G. E. Price, R.N., M.P. for Devonport, some time since obtained from the President of the Board of Trade the information that the popular Channel steamboat, the *Calais-Douvres*, was licensed for 1088 passengers, and had boats for 110. Captain Price also ascertained that the *Albert Edward*, a Channel steamboat belonging to the South Eastern Railway Company, that narrowly escaped wreck near Cape Griznez last summer, was licensed for 364 passengers and had boat accommodation for 83. The accident involved a narrow escape from a wholesale fatality. In addition to this defect of inadequacy in number and capacity, the boats are little better than ghastly "properties" in the terrible dramas enacted when ships are lost by collision, fire, or wreck. The boats should be always, but they seldom are, in perfect condition, readily accessible and available. They are usually treated with contempt and neglect, and as though they would never be wanted.

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* Transactions of United Service Institute: Meeting, 18th March, 1878.

Delay occurs, and difficulties, sometimes insuperable, present themselves in attempts to lower, launch, and disengage some of the boats; to release others from the chocks by which they are secured, from the tarpaulin under which they are lashed; to clear them one from another, and to empty them of the stores, live stock, &c., that have been placed in them; to find plugs and rowlocks, and to launch them haphazard by a tumble over the bulwarks. Got into the water anyhow, and crowded with a living freight that sinks the boat to the gunwales, the poor little craft, unfit and frail, is often staved in, swamped, or turned keel up on the crest of an angry wave. As providing means of saving life in case of shipwreck, as offering refuge or deliverance, the boat system has utterly failed and hopelessly broken down.

A few illustrations of the inadequacy of life-saving appliances hitherto provided for ships, in anticipation of distress, conclusively prove, we venture to think, the first proposition. The "o'er-true tales" are very sad, but some of them are happily relieved, almost glorified, by the aureola, so to say, with which the heroism of the expiring actors has invested them. The noble and pitiful story of the loss of the *Birkenhead* troopship is now rather old, but

Oft should the tale be told,
E'en when our babes are old,
How calm went those soldiers bold
Down to their death!

The ship had on board, belonging to many different regiments, 13 officers, 9 sergeants, and 466 men; 20 women and children; and a crew of 130 officers and men. The ship struck upon a rock near Simon's Bay, South Africa, on the 25th February, 1852. It was a calm starlight night, favourable for floating those on board if they had had readily available anything whereon to float, but they had not. There were boats for a small fraction only of their number, and of these some were so stowed away, as usual, that they could not be got out and put to use. Three boats, however, were lowered, and in these the women and children were calmly rowed off from the fast-sinking ship.

Captain Wright, a survivor, says of the noble fellows left on the wreck, "Every one did as he was directed, and there was not a murmur or a cry among them until the vessel made her final plunge. The officers had their orders, and had them carried out as if the men were embarking and not going to the bottom; there was only this difference, that I never saw an embarkation carried out with so little noise and confusion." "So died they, heroes and men complete." Many of the gallant fellows fell victims to the ravenous sharks with which the sea swarmed. Land was in sight when the ship struck. Of about 640 souls on board only 97 escaped with their lives.

The loss of the *La Plata* telegraph cable steamship in the Bay of Biscay in 1874, conveys also its distinctive lessons on the subject in hand. The boats that should have contributed benefit and have given some sense of safety, actually increased the danger of the situation, and did mischief on their own account. A heavy sea tore away one of the boats from the davits, and the davits again turned in upon and rent the ship's side, admitting the destroying flood and accelerating the ship's doom. One of the boats was smashed in lowering, another fortunately got clear, and saved 15 men. The *La Plata* was provided with so-called life-rafts, that were stowed one above another, and duly secured upon the forebridge. When the ship went down the despairing crew were seen clustering round these mocking, maddening, life-preservers (?), struggling frantically, but in vain, to get them out and afloat. Sixty-four men, electricians, engineers, seamen, &c., sank with the life-rafts. Knowledge of the provision on board the *La Plata* of "means for saving life" inspires us both with pity and indignation for those who made the arrangements, and with unfeigned grief for the hapless victims.

The *Singapore*, another wrecked ship, gives this record touching her boats' performances in the hour of need. The ship had seven boats which, with the exception of the gig, were stowed in chocks on the bridge, and covered with canvas. The jolly-boat, with 11 persons, capsized soon after leaving the ship. The majority of the crew and passengers who left in the gig were also drowned. After two hours' momentously precious time wasted, the attempt to get the lifeboat over the side had to be abandoned. In the case of the collision in the Channel between the *Forest* and the *Avalanche*, two of the three boats that left the *Forest* were swamped, and all who were in them were drowned; the boat that survived left the ship with only three oars, and with no rowlocks or rowing crutches, or plug for the draining-hole in the floor.

There is considerable variety in the horrors that attend the destruction of ships at sea, but an unsatisfactory and depressing uniformity in one feature—the miserably small part the boats perform in mitigating the disasters by saving life. The loss of the *Cospatrick* emigrant ship, burned to the water's edge in mid-ocean, near the end of 1874, was pronounced at the time even a greater disaster than the loss of the *Kent* East Indiaman. The 500 hopeful human beings speeding their way to begin life again with bright prospects in a new world, were suddenly offered, on the trackless deep, without means of escape, the terrible alternatives of death by fire or water. They could only have had time for a short shrift, and a compendious sentence closes the history of their lives. A message from Madeira curtly announced, "The *Cospatrick* burnt at sea; only three of the crew saved." Disasters at least equally appalling to this have occurred since that date. In September 1878 the saloon steamboat *Princess Alice* was returning to London at eventide, freighted with 700 men, women, and children, who had been indulging in a day's excursion trip. The pleasure-boat was struck in the river, opposite Woolwich, only a few yards from the river-bank, by a screw-collier, the *Bywell Castle*, and sank immediately, leaving the whole of the men, women, and children, who had covered the entire deck and saloon roofs, struggling in the water. The struggle was short; the helpless creatures perished miserably, asphyxiated by the loathsome Nepenthe, rather than drowned. These citizens of the "greatest city in the world" had their last and fatal bath in the sewage London contributes to its "noble river." They perished miserably—close to the seats of imperial and municipal wisdom and power. The ultimate agent in their destruction enforced upon the victims a hideous substitute for what, under almost any other circumstances, they would have exhibited—beauty, "the rapture of repose."

The owners of the *Princess Alice* made no pretence of providing boats or life-saving appliances. If the great fragile floating shell got cracked or broken, those who trusted to it must scramble out of the Stygian flood as best they could. Incredible though it may seem, we believe it is true, that nothing has been done to prevent a recurrence of a like horrible catastrophe. Should it unhappily recur, there would be once again the destruction of 700 lives; weeping and wailing among survivors; the laying out and exposure of the long lines of bloated corpses for identification; an unprecedentedly tedious coroner's inquest; a stolid official enquiry as to which vessel was to blame; a farcical assessment of damages; the burial of the hecatomb of victims; the wrangle as to who should pay the costs of burial; and then—*da capo!* The way is again clear for a repetition of the horrible drama!

Circumstances connected with the loss of the *Teuton*, September 3, 1881, especially in relation to the performances of the boats, is painfully interesting. The following is extracted from a message sent from Cape Town, South Africa, to the Union Steamship Company's office in London:—

"September 3, 7.20 P.M.—Ship struck off Quoin Point; land apparently four miles distant; moonlight; fine, clear over-head, hazy over-shore. Neither breakers nor beach observed. *Teuton* stood off, then returned towards Simon's Bay.

"9 P.M.—Boats lowered to rail and provisioned.

"10 P.M.—Water was over 'tween decks hatch in No. 2 hold. Ship was stopped to lower boats. Seven boats lowered; only one loaded, women and children and two sailors. Second boat commencing to load when ship foundered at 10.50 P.M., sucking in everything.

* * * * *

"Two boats reached Simon's Bay, one Table Bay. Captain at dinner when ship struck; thereafter remained on bridge until ship foundered.

"Good discipline; no confusion. Passengers behaved splendidly."

There were 162 passengers on board, of whom only 11 were saved; the total saved was 36, and the lost 236. It may be presumed that four out of the seven boats lowered were swamped; and it may be that the greater part of the time that intervened between 7.20 P.M., when the ship struck, and 10.50 P.M., when she foundered, that is 3½ hours, was occupied in getting out the boats. It seems strange that with seven boats and a "crew 85 strong" a larger number of persons were not saved, the night being "moonlight, fine, clear overhead, no breakers," and shore only four miles distant. The circumstances probably admit of satisfactory explanation.

The case of the steamer *Bahama*, lost when about a week out from Puerto Rico in April 1882, is another melancholy illustration of failure of the boats as means for saving life. Two of her four lifeboats were swept away in a gale, and the captain took command of one of the two remaining. It proved a deceptive refuge, incapable of keeping keel downwards for many moments, although a so-called "self-righting lifeboat." The captain and twenty men with him in the boat were drowned. Thirteen men were saved in the fourth lifeboat; the remainder of the passengers and crew perished. In the case of the barque *Langrigg Hall*, wrecked near the Tuskar in December 1882, three out of the four boats carried were smashed before the captain's order to get them out could be carried into effect.

In January last the *Cimbria* emigrant ship was struck by the *Sultan*, and sank in the North Sea. Heartrending accounts of the sufferings of the passengers were published at the time. The ship carried eight boats, but notwithstanding this, 416 out of 522 on board were drowned. One account states that "the people in the boats had to repulse the drowning to prevent over-filling. Of the four starboard boats that got off one capsized." "One boat," says another account, "was lowered, and capsized immediately. The second one also capsized, and all who were in it, chiefly women, were drowned." "Boat 3 capsized with about thirty inmates, a few of whom saved themselves by taking refuge in the rigging. The highest praise must be given to the ship's captain, officers, and the whole of the crew, most of whom perished in endeavouring to save the passengers and to do their duty."

On the 2nd February last the steamship *Kenmure Castle* bound from London to Shanghai, foundered in a gale in the Bay of Biscay. One boat only could be launched; one man only of the ten Europeans belonging to the crew was saved. The captain, first and third mates, and twenty-three Chinamen belonging to the crew perished. Eight of the passengers, including several ladies, were saved, and endured horrible sufferings from hunger and thirst, and cold and nakedness, during exposure for three days and two nights in an open boat. "The crew were in the act of launching the lifeboat when the ship went down."

The illustrations given, which could be extended indefinitely, may be taken as sufficing to prove that boats, or any other appliances for saving life at sea, in cases of fire, foundering, collision, or wreck from whatever cause, are not supplied to an adequate extent, and that they are inefficient and unworthy of confidence in their capabilities to perform even partial and fractional service. We proceed to consider,

II. The distinctive qualities and capabilities that such improved means should possess.

It is not within the scope of this Paper to recommend any particular invention or inventions, patented or other, for saving life at sea; or to urge dogmatically that it is the duty of Government to make it compulsory for the owners of all vessels carrying persons by water to provide to the full duplicate floating power for the whole of the persons they carry: that is to say, floating power in the ship, boat, or vessel itself, and, in addition, means sufficient that may be used extraneously for floating all the persons carried. We are and may probably remain for a time at a vast distance from this point. Our object is to urge the transcendent importance of the subject; to press its imperative claims for consideration upon the attention of Government and the nation; to incite, if haply we may, to practical action, and the removal of a national stigma and disgrace, that ships of various kinds, viz., the sailing conditions of which the Board of Trade does already interfere with and in some degree control, are allowed to leave our ports and our shores daily, carrying with them subjects of the United Kingdom for whose lives no better provision is made than will make it possible *for one in ten at most* to escape death in case of disaster to the ship.

Appliances for saving life endangered at sea are of two classes, one applicable to saving individual, the other to saving collective lives in danger. Of the first, the various improved life-belts, life-jackets, life-buoys, floating mattresses, and portable articles of various kinds, the merits of which are pressed upon public attention, it is not necessary to say more than that they are well worthy of attention, and that it would be a reasonable obligation to impose upon owners of passenger-carrying vessels, that they should provide a certain number and proportion of approved portable life-saving appliances, which should be kept in carefully selected places in the respective ships. Our concern herein is with means for saving the lives of numbers of persons collectively, of the passengers and crews of ships they are compelled to desert, or perish.

No top hamper or deck lumber.—Boat-service in connection with ships will never probably be dispensed with, but it has been shown satisfactorily, we trust, that dependence upon boats as the principal or best means of saving shipwrecked passengers and crews must be abandoned. The points in which the boat system is weak or breaks down suggest the distinctive qualities that the improved means that should supersede them ought to possess. It is simply impossible to carry as many boats, and of sufficient capacity, as would take off the whole of a large well-filled passenger or emigrant ship's passengers and crews; they could neither be swung on davits around the ships above the bulwarks, nor stowed away on deck, without impeding the working of the ship and prejudicially affecting its navigation. The improved means must not contribute *top hamper or deck lumber.* It would be well to reduce the boats carried on davits to a minimum; as boats so carried sometimes fail to resist the fierce attacks made upon them in their exposed situation. Ships have been seen coming out of a storm with fragments of boats hanging by the falls. In the case of the *La Plata* the davits proved powerful weapons of attack upon the ship that carried them. Inasmuch, however, as no description of life-saving appliances is likely to entirely supersede boats and davits, the materials, lines, and principles of construction of boats, the form and other characteristics of davits, and the most efficient arrangements and action of gear for lowering and disengaging boats, should be carefully considered, and the best adopted. It would be an important advantage if life-saving appliances could be provided to the supercession of the greater number of the boats now provided, either slung on davits or stowed away on deck, without adding in any considerable degree, structurally or otherwise, to the dead weight at present carried on or above the deck.

Always ready.—It would be a gratuitous infliction to say more on the subject of the difficulty and delay that so often occurs in emergencies at sea in getting the boats released, lowered, disengaged, loaded, and got clear of the ship. Cases occur, as has been shown, of ships going down with so-called life-rafts on them, and boats left in the chocks have been sucked down with the drowning people they should have saved.

Launching.—An essential quality of any effective life-saving appliance must be that it can be launched with celerity. It many instances not more than five minutes have elapsed between the time a ship has struck or been struck and has gone down.

The *Northfleet*, an outward-bound emigrant ship lying at anchor near Dungeness, a few years ago, was struck during a calm night by a passing steamer, and rapidly filled and sank, drowning nearly the whole of the passengers and crew. If the *Northfleet* had been provided with life-saving appliances always ready, and that could have been launched in a few seconds, every one of the poor creatures that perished might have been saved. The method of launching must depend upon the form and character of the object to be lowered into the water. It ought to be something made in such a manner that, although admitting of the most rapid movement, will require something simple and ready, yet more scientific, or at least precise, than the rude haphazard operation of flinging overboard broadside or end-on. A proper life-saving appliance ought to be contrived to launch transversely, and to either side of the ship.

Provisioning. — Shipwrecked mariners or others who escape from a wrecked or already sunk ship, are little likely to suppose that they are starting upon a pleasure cruise. In most cases the fury of the elements is expended upon their hapless heads, keen suffering and terrible privation may have to be borne, continuous drenching, possibly drowning and death, although still afloat. Accounts of the sufferings from cold and nakedness, hunger and thirst, of the poor creatures that have escaped from shipwreck with their lives only, are agonising to read; how much more so to have suffered! But possibly the skill that can contrive some life-saving appliance that will ride out any storm may be accompanied by the less imposing quality of forethought, that may prevent the saved from suffering the dreadful privations endured by some of the escaped in recent cases. The remnant of the crews of the *Centaur* and the *Mogul*—two colliers burned down in the Pacific—escaped with only as much biscuit and water as would, with a 2000-miles voyage before them, allow a biscuit and a half and a pint of water per man per day. They made their rations serve till they got picked up. In the more recent case of the *Kenmure Castle*, already referred to, one of the ladies who was saved states that "there were no provisions or water in the boat. I remember reading that flannel was a good thing to assuage thirst; our sufferings from this cause becoming very great, Mr. Horrocks found a piece, which we divided into fragments about 1½ inches square, and these we sucked. Our tongues were very much swollen, and we felt thirst more than hunger." Amid the horrors of the situation Mr. Higgins, third officer, went mad and drowned himself. The sufferers were thus exposed for three days and two nights. Efficient life-saving appliances should assure bread and water, at least for a few days, and secure the pitiable waifs against suffering from the horror of having "Water, water everywhere, and never a drop to drink."

Room enough for all.—Life-saving appliances provided in any given ship should be sufficient to accommodate and save every one in that ship. It is true that self-preservation is the first law of nature—"Skin for skin, all that a man hath will he give for his life." In certain circumstances, for his life a man will even surrender his humanity: care of self dominates over pity for others.

The inadequate supply of boats for crises is unfavourable to the exercise of the ordinary attributes of humanity. The steamship *Pacific*, belonging to a New York company, recently wrecked with 250 persons on board, gives occasion for the record—"Great confusion, the passengers crowding each other off the deck, and crowding the boats. One boat with fifteen women capsized." It is peculiarly horrifying to conjure up the scene at the wreck of the *Cimbria*, where "the people in the boats repulsed the drowning to prevent over-filling." It is much to be desired that some mode of saving life may be devised and adopted in which the struggle of one life against another will not be provoked, but that will give room enough for all.

Any efficient and acceptable appliance for saving life at sea, that is intended to supersede boats wholly or in part, must be able to compete favourably with boats in first cost, weight, strength, capacity, simplicity, and strength of fittings, if any; readiness for use when wanted; ease, celerity, and certainty of action; non-liability to get out of order; and the small requirements in work, trouble, or money to maintain in perfect working order.

Finally—III. The mode and authority by which such improved means shall be applied.

It is obviously, if extended and improved means for saving life at sea are to be employed, the function of Government to initiate action. It devolves upon Government to select the best means, and to exercise its authority in enforcing their application. Its powers in the matter are exclusive, and they are not transferable. Unless Government takes action, slow and uncertain improvement only, if any, is to be expected. Shipowners, like railway directors, or others at the head of great interests, have ever a bewildering variety of inventions, notions, and improvements persistently forced upon their attention. The trouble given to them begets a dislike to novelties and "improvements." To get quit of the importunities of all, they "make a rule" to listen to none, making no exception, lest they should "establish a precedent." Government is differently situated; it can take counsel with, and command the services of, the most eminent scientific men and experts, and determine, through inquiry by a Royal Commission or otherwise, whether every provision is made that can be made for saving life in case of shipwreck; whether the inadequate provision at present made does not involve, in case of shipwreck, inevitable death to a great majority of all on board ocean-going passenger or emigrant ships, or Government transports. By its professional and skilled agents Government can select speedily and satisfactorily efficient means for diminishing the loss of life at sea, and through its departments—the Board of Trade or the Admiralty—it can enforce the application of such means. "Grandmotherly legislation," or too much of the paternal in Government, is not desirable, but some better protection and care for the lives of the lieges is demanded than is given. It is surely discreditable that ships should be allowed to leave our shores, the owners of which provide no better means of natation, or possible escape from death, in the case of wreck, foundering, fire, collision, or other cause of disaster, than will suffice at most, and under the most favourable conditions, for one in ten of the persons on board. It is surely eminently unsatisfactory that any complaint concerning the inadequacy of such provision should be met with the Government explanation that "owners have complied with the letter of the law, and cannot be compelled to do more." Lost lives, if attributable to lax laws, are a shame and a reproach to the law-makers of a great civilised country; a testimony to their (heartlessness, weakness, and) unfitness to discharge their foremost function as the chosen protectors of life and property.

FISH PRESERVATION
AND
REFRIGERATION.

BY

J. K. KILBOURN.

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CONFERENCE ON THURSDAY, OCT. 25, 1883.

Mr. S. WILMOT (Commissioner for Canada) in the Chair.

FISH PRESERVATION AND REFRIGERATION.

THE recent and persistent efforts to break up the Billingsgate monopoly; the establishment of new fish markets at Elephant and Castle and Smithfield, and the reopening of the Columbia Market; and, crowning all, the International Fisheries Exhibition, already visited by more than 2,000,000 persons, gives emphasis to the interest now evinced by the public in all matters relating to the subject of fish supply, and adds to the importance of any information pertaining thereto.

The subject-matter of this paper relates to the preservation of fish by conditions of temperature, but that this may be more clearly understood it will be well to first consider the nature of the disorganising process we wish to combat, and to briefly trace the steps of the investigators that have led to the now generally accepted belief that all putrefactive action is caused by living organisms. This theory of putrefaction has taken half a century for its development, but it has not met with the hearty and prompt recognition due to its importance.

Schwann, of Berlin, was the first to prove that living germs are the cause of putrefaction, and in 1837 he made the important announcement that when a decoction of meat is effectually screened from ordinary air, and supplied solely with calcined air, putrefaction never sets in.

Putrefaction, therefore, he affirmed to be caused not by the air, but by something in the air which could be destroyed by a sufficiently high temperature.

These results by Schwann were confirmed by the experiments of Helmholtz in 1843, by Schroder and Von Dusch in 1854, by Schroder alone again in 1857, and by Pasteur in 1862.

Experiments by Prof. Tyndall in 1868–9 went to show that ultra-microscopic matter in the air was made visible by a concentrated beam of light, and by the same test he found that air that had been passed over the flame of a spirit-lamp was optically pure, and when in this condition that it had lost its power to generate life, and in this manner gave complete confirmation to the announcement by Schwann thirty years before. Tyndall's experiments extended through several years, and demonstrated beyond a doubt that infusions of meat, fish, and vegetables sterilized by heat, and freed from contact with common air, never putrefies, while the same infusions exposed to common air were teeming with life in two or three days.

In these experiments by Tyndall it was shown that the rapidity of putrefactive development in infusions infected by a speck containing Bacteria (developed germs) was something extraordinary. The development in twelve hours, with an infusion so infected, was equal to several days' exposure where the infusion was only exposed to air germs. This is most important, and should be noted, as it will be referred to again, later on. It was also found that a certain amount of oxygen was necessary to sustain Bacterial life, while, on the other hand, experiments by Paul Burt, proved conclusively that an excess of oxygen under pressure would kill Bacteria.

In 1872 Cohn of Breslau announced that "putrefaction begins as soon as Bacteria, even in the smallest numbers, are introduced. It progresses in direct proportion to the multiplication of Bacteria. It is retarded when the Bacteria (for example by a low temperature) develop a small amount of vitality, and is brought to an end by all influences which either stop the development of Bacteria or kill them."

Having now set forth the generally accepted theory of the putrefactive process, and glanced at the successive steps of the different investigators that have led up to this belief, we may pass on to the subject-matter of this paper, viz. :—

PRESERVATION BY CONDITIONS OF TEMPERATURE.

"Putrefaction," says Cohn, "begins as soon as Bacteria, even in the smallest numbers, are introduced, and progresses in direct proportion to their multiplication," and it follows as a logical sequence that the different conditions between sound fish and rotten ones are but the different stages in the process of putrefaction.

Preservation, in the sense here used, at any temperature above 32° Fahrenheit, only retards this process ; below 32° it suspends it ; but in neither case can it restore a condition once lost. It is well known that freezing completely checks all putrefactive action, and when in this frozen condition meat or fish can be kept for an indefinite length of time. A noticeable instance of this was seen in the salmon brought from Labrador, in the s.s. *Diana* in 1881. A part of this cargo was taken from London to Australia, and after this long voyage across the tropics and 200 days out of water, these salmon were found to be in good condition.

If further evidence is required of the preserving power over extended periods by freezing, it can be had by examining the instructive exhibit at the Canadian Court, where fish in good preservation can be seen that have been out of the water for eighteen months. The advantages to be derived from this method of preservation, have not been nor are they now fully appreciated ; public opinion seems to have settled quietly into the belief of the oft-repeated statement that it "destroys the flavour of fish to freeze them," and that "they go bad so quick after they are restored to normal temperature." Neither of these statements are well founded, although they may be in accord with the observations of those who make them.

The flavour of a fish and its keeping quality after thawing, depend more upon its *condition* when frozen than upon the deleterious action of the low temperature in which it has been kept. It should be constantly borne in mind that there is *no* restorative power in any system of preservation.

Notwithstanding the great advantages of this method of preservation by freezing it has not yet been adopted to any considerable extent by the English fishermen.

It is not so readily applicable to the fishing boats and methods of fishing now in vogue, as the system of retardation by temperature a little above freezing ; and hereafter our remarks will refer to this branch of the system under consideration.

The present demand is for a system by which any fish caught in English waters can be delivered in any English market in sound condition, and at a cost that is not prohibitory. To what extent this demand can be practically met is somewhat conjectural, but that radical improvements over present methods can be made will not be questioned by any one who has given the subject serious consideration.

Inasmuch as a temperature above freezing does not completely check, but only retards Bacterial development, it follows that the preserving effect can only be for a limited period. The duration of this period under the most favourable conditions is none too long, but it is in a measure dependant upon controllable causes, and these are worthy of careful consideration.

To extend this period to the utmost limit, it is of the very first importance that the preserving influence begins as soon as the fish are out of the water, and before deterioration sets in; in other words, the animal or natural heat should be withdrawn, and the fish cooled from surface to centre as quickly as possible.

This speedy cooling necessitates not only a low temperature, but room for spreading the fish, or appliances for separating them into layers so as to allow free circulation of the cooled air.

Absolute cleanliness in every department is of vital importance. You may as well lodge a perfectly healthy person in the bed of a small-pox patient as to pack freshly-caught fish in boxes or compartments contaminated with the filth and slime of previous putrefaction.

If any fisherman entertains a doubt upon this point, let him place a row of fish side by side, backs upwards, upon a filthy board in the bottom of his boat, and he will find that the bellies of these fish are completely rotten when the sides and back are apparently sound.

To secure the degree of cleanliness absolutely essential to prolonged preservation, it will be found advantageous to line all compartments where fish are packed with zinc or galvanized iron, and to make all boxes or trays in which fish are moved of the same material. These with proper care can be kept sweet and clean, and the extra cost and trouble will be repaid tenfold in the improved condition of the fish.

The prevailing practice of piling fish *en masse* one upon the other to the depth of several feet is objectionable in every sense, but especially so before the fish are thoroughly cooled.

Water could hardly pass through such a pile of fish, much less would it be possible for air to permeate it. When the fish are thoroughly cooled, there would be less objection to packing in compact masses, but even then it should not be overlooked that the bony structure of a fish is not sufficient or suitable for supporting incumbent weight.

Packing fish in ice may be fairly considered as a choice of evils. Some fish, salmon for instance, appears to bear it better than others, but in no instance does it improve the quality or flavour. Fish in ice will, no doubt, keep longer than under the same external conditions without ice, but the point to determine is whether the quality of the fish cannot be improved without the sacrifice of the preserving period, by keeping them at or near an ice temperature without the direct contact with the ice.

The theoretic perfect system, will provide suitable appliances to avoid the frequent handling of the fish, which is now a part of the usual practice.

Its aim should be to deliver fish to the different markets with once handling after they are removed from the hook or net. If this object is not completely attainable, efforts in this direction will result in decided improvements over present practice.

The system of preservation now under consideration has 32 degrees, or the freezing point of the fish, for its minimum temperature, and the question naturally arises, what is the maximum degree compatible with safety? Unfortunately this point has not been definitely determined.

The living organisms in Brewer's ferments have their activity suspended in a temperature below 50 degrees, but with Bacterial germs from 10 to 15 degrees lower would, it is believed, be necessary.

Fish, when in a perfectly sound condition, placed in a temperature ranging between 32° and 35°, will remain sound for a long time; but the range between 35° and 40° may, perhaps, be considered as debateable ground. The highest degree of temperature compatible with safety once determined, a constant temperature below this point will be found to be an essential requisite.

For a complete realisation of the possible advantages derivable from this system of preservation, it must not only begin before deterioration sets in, but it must also be continuous until the fish are delivered to the various markets for final disposal. This involves providing cold chambers in the cutters for transportation by water, cold storage on the docks, and refrigerating cars for land carriage. If these provisions in ample proportions are provided, the fisherman will be in a great measure independent of sudden changes in the weather and of fluctuations in market prices, and the fish-curer will have greater cause than now to complain* of his inability to procure fish at his own price of a quality that the fish merchants are compelled to sell.

If this system of preservation ended with the landing the fish on the docks, or in delivering them to the cutters in better condition than ever before attainable, it would then have no mean importance. But it does not end here, but can have practical application in the different methods of transportation by land or by water, and for this reason the subject of fish transportation, or fish preservation while in transit, may with propriety be considered in this Paper.

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* An actual complaint.

Refrigerating cars are important links in the chain forming the complete system of preservation, and will in the near future be considered a necessity for the transportation of perishable articles, but they cannot be endowed with the almost miraculous powers which many accredit them with. Exaggerated views of their capabilities are pernicious and misleading, and induce many fruitless attempts to solve the great problem of safe transportation of perishable articles. Speaking of them negatively, it is scarcely possible, certainly not economical, to convert cars into successful freezing chambers. The height and width of railway vans are restricted to fixed limits, and proper insulation will require 25 per cent. of the inside area, the appliances for holding sufficient ice to maintain a temperature against losses, but not including cooling the fish, will make a further requisition on the available space of 10 per cent.

The refrigerating power is from necessity derived from ice, and you not only have to pay for the ice so used, but also pay for its transportation, and it requires no further argument to show the folly of attempting to do that in the cars that can be better and cheaper done in fixed chambers. In illustration, we will assume that five tons of herrings, fresh from the water, with a natural temperature of 60° (outside temperature something higher), are placed in a car and started for London. If you obtain theoretic beneficial results in melting the ice (results which are never realized), it would take half a ton of ice to cool these fish to a temperature of 35°; practically, it would take at least 50 per cent. more than this without allowing anything for loss through the walls and openings of the car. The ice, to effect this cooling, must be debited with not only its prime cost and cost of handling, but also with its transportation, which, if from the north of Scotland, would be, say, £4 per ton for quick trains, and £2 10*s*. if by goods trains.

This illustration is on the assumption that it is possible to do this cooling in the car in the time necessary to save the fish ; but this is scarcely possible, and there would be no certainty of getting the fish to market in a sound condition, and in every case the cost would be excessive if not prohibitory. It has been shown that the space inside the car must necessarily be reduced 35 per cent., and to carry sufficient ice to cool the fish, in addition to that required to maintain the temperature against losses, would still further reduce the space, and add not less than 15 per cent. to the weight of the load that has to be paid for, to the exclusion of an equal weight of fish.

With a car properly insulated, and with suitable appliances for containing the ice and collecting the deposited moisture, a low temperature may be maintained against the continuous losses ; more than this is impracticable, and if attempted will inevitably result in loss and disappointment.

In brief review, it has been shown that the disorganising forces that cause all putrefaction, are minute living organisms invisible to the naked eye. That these organisms multiply with extraordinary rapidity in favourable conditions of heat and moisture, that their development is materially retarded in temperatures between 32° and 40°, and is entirely suspended in any temperature below the point of congelation.

In the destructive attacks of these organisms against dead tissues, sooner or later the living forces will prevail. Preservation, therefore, resolves itself into the question, How long, and by what means can these disorganising forces be kept quiescent?

In answer to this question I have before stated, and deem it of sufficient importance to repeat, that the fish, as soon as out of the water, should be thoroughly cooled from surface to centre, and as quickly as possible, to a point that will effectually check the development of these destructive germs. I have also stated that scrupulous cleanliness in every department is of vital importance; failing in this, you infect the fish with developed Bacteria, and accelerate putrefaction by many hours, if not by days.

The inconsistency, one might almost say the absurdity, of taking ice from the shore to preserve the fish, and at the same time take the ripened germs of contagion to destroy them, will be apparent to every one who rightly understands this disorganising process.

To secure the degree of cleanliness necessary, metal linings to the storage compartments, and metal boxes for holding and handling the fish, were recommended.

Piling fish one upon another tends to shorten the period of preservation, and frequent handling impairs the quality.

It will be an important point gained to be able to land fish in better condition than ever before attainable, but no system can be considered as completely successful unless it includes the delivery of the fish in a sound condition to the various markets for final disposal, less than this will not fulfil the public requirements.

To bring fish fresh from Ireland or the north of Scotland, will require an organised system, complete in every detail, and the preserving influence must be continuous from ocean to market.

Did time and the limits of this paper permit, detailed description of the requisite arrangements would show that the system outlined is not by any means an impracticable one or difficult to put in operation. It was not brought to your attention in the belief that it was a new discovery, nor that it would be revolutionary in its operation; but solely in the endeavour to contribute in a small degree to the fund of practical information relating to Fish Supply.

Thanking you, Gentlemen, for your patient attention, I would, in conclusion, express the hope that the views I have set forth will provoke discussion, especially upon the point of packing fish in ice, and that they may also induce experiments to determine the maximum degree of temperature compatible with safety.

DISCUSSION.

Mr. KENNETH CORNISH said he had paid a good deal of attention to this subject, and the question of chilling or freezing fish had also come under his consideration. Mr. Kilbourn would be right in protesting against the practice of absolutely freezing, because the result was to cause the water in the fibrillæ of the muscles to expand, which burst and set free the juices as soon as thawing commenced. This was the reason why meat which had been frozen went bad so rapidly. What was proposed was perfectly practicable, and he believed the new processes for the purpose would probably be brought forward as soon as the new Patent Act came into operation. The amount of cold required could, he believed, be regulated to a degree which at present there was no means of doing. From experiments he made, he came to the conclusion that the proper limit would be between freezing-point and about four degrees higher. There was another advantage in dealing with meat not absolutely frozen, that you minimised the evaporation which went on to a considerable extent when meat was frozen, as could be seen by any one who examined the splendid samples in the Canadian Court. He thought the Norwegian stove might be adopted with great advantage in the formation of chambers in which meat or fish was kept. The practice of bringing it in contact with ice resulted in rendering it more flabby or flavourless, but if put in chambers of this kind there would be no occasion to change the air, and there would be less loss by evaporation. He saw no reason why flowers, meat, animal, and vegetable substances in general should not be kept from four to five months without serious deterioration. About eighteen years ago he made an experiment in trying to preserve meat by complete exhaustion of air; he had a rat and put him in an india-rubber package, and exhausted the air with a powerful pump. This was in July, and at the end of August he opened the package, and put in another rat freshly killed by the side of it; the rat freshly killed putrefied long before the other did, but for various reasons he did not think this method would be practicable on a large scale. He thought it was quite practicable to bring animal substances from all parts of the world by the process of chilling, but a good deal had yet to be done in the mechanical and scientific details. Another point which Mr. Kilbourn had not touched upon was the possibility of depriving animal substances of their water without injury to the albumen or ozmazone or juices, or altering the flavour, and he believed he had found a practicable solution of the problem, but he was waiting for the new Patent Act to make it public.

Mr. ALWARD (Grimsby) said it had given him great pleasure to listen to this Paper, and wished it was practicable to carry out the proposed scheme; but, as a practical fisherman, he did not think it was—to any great extent, that is to say—applicable to the North Sea trawl fisheries generally, from which the greatest supply was received. Several attempts had been made with a view of preserving fish in that branch of the fishing industry, but they had all failed. As they had heard, there was a difficulty when dealing with fish in bulk. The cold would either not penetrate through the bulk of the fish at all, or not to a sufficient extent to destroy the chemical action which was going on. But if the fish had to be separated one from the other, he was afraid it could never be brought into practical use to a large extent. With very elaborate contrivances, such as were found in ships fitted up for the purpose of bringing meat from distant parts of the globe, it might be practicable to preserve animal substances; but to apply it to the fisheries of this country was a very difficult question, unless some new discoveries were made, or the present system was much improved upon. He had salmon in a complete state of preservation, but there the conditions were more favourable, and salmon was a solid fish, very different from the majority of that which was caught in the North Sea, which consisted of a great deal of water, which could not be extracted without destroying the fish. They had been trying to substitute refrigerating apparatus for the ordinary method of preserving in ice, which was now carried out to a large extent; but he feared, until some further improvements were made, they would have to be content with the present system. He quite endorsed what Mr. Kilbourn said about cleanliness and the lining of boxes and houses, where fish were stowed, with metal would be very useful. He had hoped to hear something new, for the ordinary refrigerating apparatus, he was sorry to say, had totally failed. Several vessels from the port of Grimsby had been fitted up with the view of preserving their own cargo in a semi-isolated condition, but without success, for although they were able to prevent decomposition, the fish were practically destroyed for marketable purposes, they had such a wizened and disagreeable appearance. With cod, ling, and fish of that kind, a great deal of the appearance of the fish depended upon the eye, and if it were frozen into a solid mass of ice, the fish had just the same appearance as if it were stinking. Unless you could preserve the brightness of the eye and the fresh appearance of the gills, the fish would not be saleable. He was very pleased to find that this subject was engaging the attention of gentlemen who had the means and ability to improve upon the present system, because an immense amount of waste constantly went on in the fisheries of which the general public had very little conception.

Mr. F. N. MACKAY said he had been connected for some years with artificial refrigeration, and he should like to say a few words on the points raised by the last speaker. Of course the most important point was the bringing of the article to market in a state as nearly as possible similar to that in which it was taken out of the water; and the description they had just heard of the state of the fish after having been frozen was practically that of a fish which had been to a certain extent decomposed. He believed that to be due to excessive freezing. He would point out that at Stand 720 in the Exhibition was shown, on a small scale, an apparatus devised for the purpose of meeting this want, namely, that of cooling the fish in its watery state without freezing. It had been stated that it was necessary in order to accomplish this object that each fish should be separate from its neighbour in order that the air might circulate about it; but he would throw out the suggestion that air was a very bad conductor of heat, and it had the effect of destroying for market purposes what it had preserved. If the fish were packed to a certain extent in bulk, and were allowed to come in contact with cold surfaces of galvanised iron, which could easily be kept at a temperature of 35°, the fish was in actual contact with the cold surface, and the watery particles between acting as conductors would in a short time make the fish of uniform temperature without freezing it. The salt water brought in with the fish would also tend to prevent ice being formed, and a temperature of 30°, or even 28°, might be obtained without actually forming frost on the fish. This would prevent the drying-up of the fish, and would certainly stop putrefaction, and enable it to be brought to market in the desired condition. In the exhibit was shown, as an example of what was proposed to be put on a steam trawler, the machine itself being driven by steam. There were compartments 3 feet square, composed of hollow metal walls, through which the refrigerating brine for the machine was circulated at a temperature of 20° to 25°. These compartments had been kept at a temperature of from 30° to 32° throughout the Exhibition. This machine had not yet been applied to a trawler, as it had only lately been designed, on the suggestion of certain gentlemen of Hull, Grimsby, and Edinburgh. The distinguishing feature of the apparatus was that it did not cool the air and make the air the means of abstracting heat; but the fish itself was used as a conductor, and in this way the temperature could be regulated with the greatest facility. Machinery on the same principle had been devised for cooling chambers used in breweries, and had proved very successful.

Mr. HESKETH said he had carried out several experiments at Messrs. Hall's works at Dartford with regard to the preservation of fish, and the results did not entirely tally with what was said by Mr. Alward. About half a ton of fish was sent up from Grimsby packed in the ordinary way with ice, and immediately on its arrival it was placed in a chamber cooled by cold-air machinery, where it was kept at a temperature of about 25° for six or seven weeks. At the end of that time the principal part of the fish was sent back to Grimsby, and was there pronounced to be in very good condition. The small portion which was kept was sent round to his personal friends, and he ate some himself, and none of them were able to discover any difference between it and perfectly fresh fish. Mr. Mackay remarked that the freezing process had the effect of drying the fish, but he could not see how that could be, the fish being frozen immediately they were placed in the cold chamber, so that hardly any time was allowed for the moisture to get out of them. With regard to the process described by that gentleman, he fancied there would be a difficulty in getting the fish cooled down in bulk. He did not think that fish two feet deep on a surface kept at a temperature of 32° would cool through for some considerable time, and his reason for saying so was that some of the fish put in the cool chamber were so placed in the boxes as they were received, and it was found that those in the centre did not cool for some considerable time. If air which could get into the interstices of the fish could not get at them sufficiently to cool them down, he did not think the heat would pass along through the fishes' bodies quickly enough to cool them in moderate time. It seemed to him, in order to bring fish from great distances, it was absolutely necessary to freeze them, but merely for bringing them from the trawlers to the market the cooling could be accomplished by cold-air machines, which might be made to occupy a very small space fixed against the bulkhead of a ship, and would require very little attention. With regard to the fish not looking well after they were thawed, he could bear testimony to the fact that nobody, except perhaps an expert, could tell the difference between a fish which had been frozen and one which had not.

Dr. RAE said if any one wished to see specimens of frozen fish they could easily gratify their curiosity in the Exhibition by visiting the Hudson's Bay Company's exhibits. He had only just been looking at them, and thought they quite bore out what was said by the last speaker, for no one hardly would suppose the fish had been frozen, and those who ate them could not tell the difference. He was not now speaking of common kinds of fish, but of salmon, though in one part of the Hudson's Bay territory the whole people lived on frozen fish for a considerable time. All the men in the employ of the Company on the Makintz River were fed on this, and it was one of the best diets they had, though they ate them without bread or potatoes. He had lived there several years himself, and had had but little else than fish to eat. They could even notice the distinction between meat-eating and fish-eating men on seeing them together. The men who lived on animal food altogether, as used to be the case in the old buffalo days, had a more dried-up look; they worked well, but they had not the wholesome fresh look that the fish-eating men had. He was certainly convinced that fish was not injured seriously by being frozen, for it was kept there many months in that state.

Sir Ambrose Shea then proposed a vote of thanks to Mr. Kilbourn, to whom they were greatly indebted for having put forward the Paper, which had elicited so much interesting discussion. He had listened with a great deal of interest to the observations of Mr. Alward, who put forward some views calculated to shake faith in the entire efficacy of the means proposed in the Paper, but it was only through the interchange of conflicting opinions that the object they all aimed at could be effectually accomplished. He believed the great object should be to endeavour to preserve fish without freezing. Several gentlemen who appeared to be well informed on the matter seemed to be of opinion that frozen fish were not injured, but from his little experience in the matter he came to a very different conclusion. A great deal, however, would depend upon the length of time during which the fish was preserved frozen. Still, he believed the great aim should be to avoid the necessity for freezing, and to devise some means by which the temperature could be uniformly preserved somewhat above the freezing-point. They knew that meat was brought across the Atlantic perfectly sound and good at a temperature above the freezing-point, and, although Mr. Alward admitted that, yet he appeared to bring forward very good reasons why there were practical difficulties in the way of applying the same means to the preservation of fish as they were caught in boats round the coast. He could not but express his regret that these Conferences were so thinly attended, but this might arise partly from the difficulty which some might have in coming a long distance to attend, and partly from the feeling that in due time all these Papers would find their way into the public press, where all would have an opportunity of perusing them. He believed they were a very important adjunct to the Exhibition, and would materially aid in carrying out the great objects for which it was established.

Major SEWELL GANA seconded the motion.

Mr. ALWARD, not only individually, but as representing a large body of persons connected with the North Sea fisheries, begged to support the motion most cordially.

The CHAIRMAN, (Mr. Wilmot), in putting the resolution, said he held in his hand a slip from a newspaper to the effect that some thirty-five tons of fish were thrown aside in the London market the other day as being unfit for food, yet at the same time thousands of poor people were on the point of starvation for want of food. Surely some means ought to be provided whereby such a state of affairs could be prevented. He believed this was largely brought about by avarice and greed upon the part of the fishermen in catching more fish than was necessary to supply the market, and the fish dealers allowing overstocks of fish to spoil rather than sell them at reduced prices to the poor; too many were taken, they were brought to shore and, without proper supervision, were sent off, and in many cases became unfit for food before they reached their destination. In Canada, fish were caught in the great Western Lakes in great quantities. They were put on board of little steam-tugs in refrigerating boxes, and conveyed, perhaps, 100 or 200 miles to the nearest harbour or railway station. The boxes were then put on the railway car and went on in some instances 1,000 or 2,000 miles, and were sold as fresh fish, and were eaten as readily as those caught within a few miles of the market. He had been struck with astonishment that within the area of this small island, as it was compared with Canada, similar means were not introduced, instead of having so many fish spoilt.

Not only were the fish taken to market, but they remained in the cellars of the dealer for a week or ten days after they arrived there. The process was very simple; the fish were taken out of the water in tons weight; on deck were a number of boxes, of which a specimen could be seen in the Canadian Court, forwarded by Mr. Leckie of Toronto, each box holding about two tons. It was packed round the outside with non-conducting material; a layer of finely-powdered ice was put in the bottom, then a layer of fish, then another layer of ice, and so on until there were fifteen or twenty layers of fish and ice, and it was then shut down tight and sent off. He need hardly say that, if the fish were not in good condition, the inhabitants of the great cities in the United States would not eat them. He had often eaten this fish in the best hotels in Toronto, and it was difficult to distinguish them from fish caught in the bay in front of the city. If some similar mode were adopted here, they would not hear of fish coming to the London market and being condemned the next day as unfit for human food. It was said by some person that frozen fish were not fit for food, but he could contradict that *in toto*. The fish he had previously been speaking of were principally white fish, pickerell, pike, sturgeon, and fish of that order; but he would now say a word or two with regard to salmon. This was caught in large numbers in the Canadian rivers. This year there had been so plentiful a supply that they had been unsaleable at a remunerative price, and large quantities were immediately frozen. Since he had been over here he had written to dealers in Canada to have some of this frozen salmon sent to England, but the reply he got was that they could not do so, as they were under contract for all their fish to be delivered next January, February, and March in New York, Boston, and Philadelphia. Now, if in Canada they caught fish in June, July, and August, and froze them up, and the fish dealers in New York and Boston would buy them for delivery early next year, it was evident the fish could not be very much deteriorated by freezing. He had eaten those fish for several years past, and it was the regular custom to have it on Christmas Day, when, the waters being frozen, of course it was impossible to catch fresh fish, but they were considered as good then as when caught in June. There might possibly be a very slight difference in the quality, but that was not the question. Fish could be preserved in this way so as to form food for the greater portion of the people, and if those who cultivated more fastidious palates were not satisfied with it they need not eat it. It seemed to him a burning shame that so much fish should be thrown away as unfit for food when there were evident means of preserving it. In the Canadian Court there were specimens of fish caught in June 1882, which had been kept in the frozen state up to the present time. A fortnight ago one of those cases was opened and some fish taken out, and they were so hard they had to be sawn in slices. He took a piece home and had it cooked, and it certainly was very good, but perhaps to the epicure not so delicate as a piece he might have bought in the market; but it was delicious food, fit for any one to eat, and he certainly thought the more frozen fish they could get the better. The vote of thanks was then carried.

Mr. KILBOURN, in reply to the remarks made, said: Mr. Cornish will see, when he has an opportunity of reading the Paper, that he has not in all respects rightly interpreted my views as to the value of preservation by freezing. Instead of protesting against the practice of absolutely freezing, I most emphatically endorse it, where it is necessary to extend preservation over considerable periods of time.

I am well aware that many object to this method of preservation, believing that freezing impairs the flavour, but if any one entertaining this belief will take two fish as soon as caught and killed, pack one in ice and freeze the other, and keep them in these respective conditions a given length of time, it will be found that the frozen fish, when cooked, is in every essential particular equal to the one packed in ice; and if preservation extends beyond a very brief period the frozen fish will be the best.

Preservation by retardation, if properly carried out, may be made to extend over a sufficient period to meet the present requirements of the English fishermen, and if the business should come to that stage of development where freezing in a measure supercedes curing for the surplus stock, then the preliminary operations requisite for the retarding process would be quite suitable and necessary as preliminary to freezing, which, for economical reasons and others, will be mainly done on shore.

The fears expressed by Mr. Alward and Sir Ambrose Shea that the method outlined in the Paper read would be impracticable for the North Sea fisheries are, it is believed, altogether groundless. It is true that the attempts alluded to that have been made to solve this great problem were complete failures, but the reasons therefor were manifest, and I predicted the result before the trials were made. The theory of all putrefactive action, as set forth in the Paper read, is well established, and when clearly comprehended it will illuminate the course necessary to take. The system of preservation outlined does not require new invention for its complete development but rather a judicious application of discoveries already made; neither is it confined to any particular method or machine for producing the cooling power, nor based on hard-and-fast lines which cannot be varied, but may be adapted in a practical manner to either smack, cutter, or railway van.

It would be discreditable if not disgraceful not only to artizan but capitalist, if a system that has been proved over and over again equal to bringing mutton from Australia and salmon from Canada and Labrador in a frozen state, and beef from Chicago to London (more than four thousand miles) in an unfrozen state, cannot find such application on boats and vans as will keep fish in a sound condition while in transit from any part of the English coast to the various English markets.

Mr. MACKIE proposed a vote of thanks to the Chairman, who had been so regular in his attendance at these Conferences, and had conveyed so much useful information to those who attended.

The motion was seconded by the Chevalier BICKER-CAARTEN, and carried unanimously.

The CHAIRMAN, in reply, said it was very gratifying to him to find that his remarks had been received with approbation. One of the main points which he had endeavoured to impress upon those who attended those Conferences was, that if the present destruction of fish went on unchecked, the time would come when the supply would be entirely exhausted.

NOTE.—Since the above discussion took place Mr. Wilmot has taken some of the salmon frozen in June 1882 out of the Canadian Freezers on exhibition, and presented them to persons of high distinction in London. In dining with one of these, the salmon when served up was not distinguishable by the host or his guests from fresh-caught fish.

THE
BASIS FOR LEGISLATION
ON
FISHERY QUESTIONS.

BY

LIEUT.-COLONEL FRANCISCO GARCIA SOLÁ,

SECRETARY OF THE SPANISH COMMISSION AT THE
INTERNATIONAL FISHERIES EXHIBITION.

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CONFERENCE ON THURSDAY, JULY 19, 1883

His Excellency the Marquis DE CASA-LAIGLESIA, the Spanish Minister, in the Chair.

THE BASIS FOR LEGISLATION ON FISHERY QUESTIONS.

WHEN we speak of the depletion, or complete exhaustion of fisheries, it must be understood that these terms are not used in an absolute sense, but only so far as they affect the supply for the use of mankind, or, in other words, the output of the industry. The quantity of fish may be diminished in two ways, in the one case, when the catch exceeds the reproduction, and in the other, when the fish are frightened away from the haunts of the fishermen. I quite agree with the views so often expressed as to the difficulties which have hitherto stood in the way of a proper study of the life and habits of the inhabitants of the sea, which is the only thing that would conduce to an early solution of the problem ; but the experience gained from ascertained facts concerning fisheries, throws enough light to induce a conclusion, in any rational mind, in one or the other direction.

With regard to sedentary species, I do not think there is the least doubt that these *can* be exhausted by being overfished, or by improper methods of fishing, since it is clear that if a natural oyster-bed, for example, be dredged constantly and no time left for its reproduction, it will amount to the same thing as if one repeatedly dredged stones or other inert material—that is the bottom would at last be perfectly clear of them.

Such an obvious argument as this needs no confirmation, but if any such confirmation were needed, we might cite what has occurred on the north-west coasts of Spain, where, until the beginning of the present century, so great was the quantity of oysters in the beds that they were sold at four cuartos, or a little more than one penny per hundred, while the present price averages 12 pesetas or 9*s.* 7*d.* for the same quantity. Even if we take into account the small consumption at that time, owing to defective means of communication, this circumstance is insufficient to explain the enormous difference just mentioned, which points clearly to the complete exhaustion of the beds.

With regard to species which lead a more or less migratory existence, there cannot be the least doubt that if man had complete control over the area occupied by each, the same principle of more fish being caught than could be reproduced would lead to exhaustion likewise ; what has to be determined is, how far man has such control in a given locality. The old fishermen of the Mediterranean relate that they remember having seen in their boyhood, species which they do not see now, but we need not attach any great importance to such a statement, until we have the means of ascertaining whether the fish have gone out to deep waters, but if there should be no communication between two seas, and they were really exhausted under certain conditions, this fact would of itself prove the theory of exhaustion just propounded. The case is, however, different with the ocean, the immensity of which makes extermination impossible except in the case of fish whose nature leads them to resort to the shore for spawning purposes or for food.

This immensity and the impervious conditions of the element in which fish live, throw such obscurity over their mysterious life that it is not possible to pronounce an opinion upon this question, except so far as we are in a position to do so from observations made from the coast and its surrounding waters, and even then the comparisons must extend over long periods of time. It is well known that both on land and sea many species of animals have entirely disappeared, and their fossil remains alone come down to confirm historical references. But without going back to such early times, we may refer to the great diminution in the number of whales within the present century, a diminution probably more owing to the voracity of other aquatic animals than to overfishing by man.

We can also cite the diminution of the smaller species in proof of our assertion, the tunny, for example, as referred to by ancient historians. Strabo and Pliny both call attention to the enormous quantities of this fish caught by the Phœnicians, and the arm of the sea near Constantinople owes its designation of the Golden Horn to the immense wealth which the Byzantines drew up from it in the shape of tunnies, and lastly, Caio Plinio mentions the fact of the fleet of Charles the Great encountering a shoal of tunnies which altogether impeded his progress. In much later times the reports of the erudite Father Sarmiento give particulars as to this fishery, from which we can judge of its decline ; the reports showing much greater quantities than those now obtained.

The tunny is a migratory fish living in the deep sea, and returning every year to the eastern parts of the Mediterranean, at the same season, to spawn, following the line of the European continent when it arrives, and on its return after spawning, taking the coast of Africa and passing on through the Straits of Gibraltar to the Atlantic.

Now it will be easy to explain the diminution of this fish since historic times, by the fact that of the great quantities which enter the Mediterranean to spawn some are caught by the fishermen *after* spawning, but the great majority *before* fulfilling this function. How then can we conclude that the cause of this diminution is not owing to the action of man?

It is quite true that many centuries may elapse before the complete extinction of a migratory species from the vast expanse of the main; perhaps before this exhaustion takes place some of those abnormal conditions may occur in the history of our planet which will disturb the essential conditions of the history of those species, but even in this remote contingency we must not lose sight of the fact that the biological regions are not unlimited, and that every species seeks out its abode where nature and its kindred elements have produced the required conditions, some species being only able to live in low temperature, others in high ones, some again cannot live in estuaries, and those species which are limited by temperature are again subdivided into others separated by the pressure of the waters, some being obliged to live at a great depth compared with others, and among other limitations there is the question of food and shelter, the appropriate motion of the currents; and lastly, that the depletion be not carried to such an extent as to prejudice food-supply, and thus be the first step towards an end of the industry.

It is now time to enter on the second head of the theory propounded. We have said that the depletion of the fisheries or their complete exhaustion is not referred to in its absolute sense, but only in the sense of their use for mankind, and from this point of view let us demonstrate the most practical point, viz., that in which fish are compelled to abandon places which are within the reach of fishermen.

It is not the opinion of Spanish fishermen exclusively that the sea fisheries are inexhaustible, but it is an idea that gains general credence; they know the fabulous reproductive power of fishes, they contemplate the huge expanse the fish live in, which they suppose to be full of the species they try to catch; they compare these spaces and their enormous population with those actually taken, and the distance run, then, without troubling their heads further on the matter, jump to the firm conviction that fisheries are inexhaustible. They let down their nets into the sea eager to gather in the fruits of their precarious calling, only to draw them up empty, try a second and third time with the same result, and then return home to think on the bad issue of their day's toil; and when this is repeated day after day they attribute it all to the variation of currents, to atmospheric influences, to the noise of artillery on vessels and on shore, to the transit of steam ships through the fishing grounds, to epidemics among the fish, to caprices of fortune, to witchcraft, and, in fine, to anything and everything, rather than the destruction caused by an overworking of the fisheries.

Sometimes a more thoughtful individual attributes this to the method of working the fishing tackle, he notices that the drag nets in sweeping the bottom bring to the surface rooted up vegetation which serves as pasture for one species, as shelter for another, and as a nursery for the young of others, and also observes that among the entangled herbage are myriads of germs and young fry macerated by the dragging; he counts up the grand total of individuals destroyed by such a proceeding, and then reflects on the enormous quantity represented by the wholesale destruction of so oft repeated a system among all maritime nations, and then arrives at his conclusion as to the part man plays in the depletion of fisheries, and if he knows too that the shallow bottoms in proximity to the shore are the necessary spawning places of many species, he can entertain no doubt that the present methods of fishing are disastrous.

Not being able to entertain any principle not sanctioned by practice, let us next examine what in their essentials are these fishing utensils used in different numbers and slight variations of detail in nearly every country. They consist of two bands of net, with a bag or sack of the same material but of much closer texture, the borders or lower ropes of the sack being provided with leads throughout their length, to insure the sinking of the net, and on the upper ropes are attached cork or other material of a lighter specific gravity than water to cause them to float, by this means keeping the nets vertical and the mouth of the sack open. The net thus reaches the bottom of the sea, and at the extremity of both bands there are attached two cords, generally of great length, by which the apparatus is dragged on shore by one or two boats, according to the class to which it belongs.

Hence it will be seen that these nets can only be used on flat bottoms without stones or other obstacles to catch them. The net in its passage roots up the vegetation which grows in such places and hauls them to the surface or on shore; these are found entangled in the net in great quantities, and with them during the spawning season of those species which spawn along the shore one encounters among the seaweed multitudes of eggs more or less developing, and young fish crushed completely by the movement of the apparatus. That these facts reveal an enormous quantity of fish destroyed in repeated castings there should arise no sort of doubt, and the same thing has been seen by me on various occasions in the *bou* or *chalut*, which is worked by boats in the Mediterranean and in the southern ocean of Spain, as well as in the *jábegas* and *boliches*, which drag from land throughout the Spanish continent whenever they find suitable localities. I have seen more than this. I have seen in the Gulf of Valencia drawn up in the sack of one of these nets so great a quantity of red mullet that they were all caked together, such was the maceration to which this delicate fish had been subjected, although the injury was the cause of a much less price being obtained for fish captured in this manner.

Of the disastrous results of this fishery we have unquestionable examples in Spain. A law fixed an imaginary zone near to land within which this kind of fishing was prohibited, and when at the end of some years the fishery of non-prohibited places was exhausted, application was made to fish within the zone, the Government prudently refused to permit it. A close time having been also appointed the fishermen asked that it might be deferred. At some places, Malaga among them, the fishermen who had used these nets for years growing tired of the damage they caused to their catch, bought them all up and burned them, at the same time petitioning the government for their extermination from the province. Now what do these facts prove? They prove without a shadow of doubt two things. The first, that fish obtained by trawling are of inferior value to those caught with hooks or floating nets, on account of the crushing which renders them liable to early putrefaction. Secondly, that in those places where trawling is allowed, the fish are all completely extinct. Against these facts no argument is possible.

Exactly the same thing takes place with trawling gear plying nearer the shore. Thus the *jábega* had spots appointed to it along the coast, and after working for some years completely denuded them of fish. The *boliche* had to change its position for exactly the same reasons, likewise the *boliche de rada* which operates in small areas where fish are brought for sale and to be salted. Even on the coasts of those countries which have ground suitable for this gear, the fish are so pursued that they do not remain permanently, having no means to satisfy their necessities.

It is not only this gear which operates injuriously on the produce of the waters on the coast, but the use of poisonous materials and explosive substances and stakes in the *embouchure* of rivers, with many other things by which man mars the spontaneous production of the finny tribes. Two evils are attached to the use of explosives, the fish caught by it die without distinction of size (it telling with especial force on the young), and the noise frightens those that escape alive. In poisoning the waters the fish are of course deprived of the means of living in them, at the same time that the dead ones are rendered unfit for food, and repugnant to the public taste. With regard to the damage done by stakes at the entrance to rivers it must be remembered how many littoral species ascend to spawn in the limpid bottoms whose fine sands aid them in depositing their eggs, and afford facilities for impregnation in these tranquil places, which would not occur in frequented localities. It speaks nothing with respect to these impediments to transit, that certain species live both in fresh and salt water, since the wise English law on salmon fisheries expressly prohibits them. The result of not having a similar law in Spain is that, while at the end of last century and the beginning of this, this fish was so abundant in the rivers of the north and north-west of Spain, that servants bargained with their masters that they should not eat salmon more than two days a week; the price is now so high in the capital as to place it beyond the reach of all but the highest grades of society, and even what is there consumed comes in a great part from abroad. This state of things points to the necessity of legislation, and in consequence, the question of a change in the law is at present under consideration by competent authorities.

Having shown and explained the injury occasioned in Spain by abuses in the fisheries, and also the necessity for placing rational restrictive measures on the working, it will doubtless be asked whether, owing to the extent of the prejudices existing on the subject, the very fishermen for whose benefit they were put forward would not ignore them. Their objection has very little practical importance and can easily be met. In the first place fishermen desire only to have plenty of fishing and to have it at little cost. In the second—when they know the causes of the evil—it is necessary for them to employ all their energies and make some sacrifice to respect the means of reproduction, because if only a few abstained from joining the concourse the whole thing would be a failure. If the sea could be subdivided like the fields, so that each section would respect reproduction and would not gather in the harvest till it was ripe, there would be no need for restrictive measures, but since the exploration of the deep is common property there can be no remedy but such as is obtained by the Government of each country. The necessity for this not only interests fishermen, but is a question of the food supply of nations.

LEGISLATION.

IT has been shown on all sides that if the abuses practised in fisheries be not substantially ameliorated the fish will either be frightened away, or abandon the stations, which amounts to the same thing, since it matters little to a country that the normal reproduction is kept up, if they are not available for food.

Hence the necessity of remedial measures for the existing evils. But what shall these measures be ? That is the question we must answer, a question too complex to be defined, since it depends on a multitude of contradictory elements. The natural condition of the waters, the diversity of creatures sought out from it, the differences in the life and habits of those creatures, and the obstacle which the element they live in presents to a study of those habits, have allowed very few persons to study ichthyology: whilst the inhabitants of a country, their social condition and fundamental laws, and lastly the free concurrence of individuals in a common ground of action, are among the many elements which complicate the solution of the problem.

The principle for fishery legislation on a sound basis is a very simple one, and merely consists in the establishment of equilibrium between the spontaneous production of the waters and that which is drawn out of them. But the carrying out of this principle and making the regulations to meet it doubtless present a multitude of insuperable difficulties.

An absolutely restrictive system and one which would cut at the root of those inveterate abuses sanctioned by constant practice and of old date, however well considered and reasonable it may be, will inevitably meet with an opposition difficult if not impossible to overcome. In the first place, under the shade of those abuses established, recognised, or tolerated by former laws, there will have grown up a crowd of well-to-do interests which it is not possible to disregard, and hence the necessity for a fundamental principle of the law dealing with such cases, if the State does not take measures for satisfying them pecuniarily, of which case we have in Spain so eloquent an example.

It results from what has been said that the Government should prevent the use of trawling gear, called *bou*, since ample information and an attentive study show the evident necessity for putting an end to this system of fishing. It has been proposed to issue regulations imposing on its exercise specified limits of time and distance, and forbidding the employment of new gear, but this suggestion is of no avail in practice, as the possessors of such gear naturally desire to keep them as long as possible and never proceed to break them up. Thus the essential point of the law is evaded, which would not be the case if the government bought up the apparatus and awarded compensation, at the same time absolutely forbidding the employment of such apparatus in fisheries.

In imposing a system of absolute restrictions, it must not be forgotten that these will be sure to provoke an unpopularity which no government can afford to disregard.

If, on the other hand, we pass to the opposite point, viz., altogether free working, it is a Utopian idea that by this means equilibrium will be maintained between production and extraction without any government intervention, as was recently done in the United States in the way Professor Brown Goode so clearly explained to us.

We do not know, however, if this modern procedure will give in the course of time the expected favourable results, and years must elapse for its thorough trial, but we believe it will—we believe so because we have great faith in the progress of that grand nation; but on the other hand we do not believe it will cure all ills, for it is a principle contrary to reason that fishermen should destroy and government reconstitute. But to clear this question from the density of the waters, we must fancy ourselves on land and suppose that in working the mountains of a nation the same means were adopted, viz., unrestricted felling of trees and wood, the government being charged with replenishing them at the cost of the State. The system would render the mountains still more costly and unproductive, for if the nursery grounds contained enough trees for restocking them, they would not replace those cut down in their natural size.

This is the weak side of the system, as establishments conveniently distributed along the coast are not sufficient to maintain the fundamental equilibrium of production, if when young fish are drawn out of the waters they are not returned to acquire maturity, and for this the action of the law, in a restrictive sense, is necessary at the present time.

Besides, to ensure the completeness of the system, it is necessary that these establishments should be of sufficient number and possess suitable conditions for the reproduction of the various edible species, as otherwise what the system would gain on the one side, it would lose on the other, and this presupposes a heavy outlay on the construction and maintenance of the hatcheries.

We do not wish to censure a system, adopted with so much success in the United States, which assumes that the best way to ensure perfect working is to leave it in the hands of the workers to spontaneously guard their own interests without the intervention of the State, because by this means there springs up a knowledge of reproduction, they see for themselves the advantages obtained by preservation, the rude operators learn something of the life and habits of the species kept at the stations, in a word, men who have hitherto thought only about fishing, think about the stocking of fishing grounds.

One word with respect to the fry proceeding from these establishments. This is the vulnerable point of the system. The United States consigns them to the care and watchfulness of protecting societies, but the representatives of other nations, who do not act in this spirit of association, and are not in a condition to bear the increasing expenses of a complete plan of fish hatching establishments, will agree with me, that however excellent may be the system under discussion, it is not fit for general adoption, having no other resource but that of looking to the State to keep up the production by means of a provisional law, which, while giving every possible limit to the industry, contributes in a marked degree to prevent the depletion of the fisheries.

These limitations cannot be determined in a general sense, because in them there enter conditions which cannot be disregarded, conditions which spring, some from nature itself, others from the laws, usages, and customs of each particular nation. It will hence be seen how much in common are the interests of fishing in all countries, all having the same fundamental principle, and it will then be possible to adopt measures having the same affinity and end.

In the first place it is necessary to take into account the fact that the same principles cannot be established in all waters. Thus Spain bounded by two distinct seas finds it necessary to depart from the general unity which applies to every national law, the industry being carried on under different conditions. The coast of the Mediterranean which undoubtedly, as has been shown, produces more than the Atlantic coast, has great depletion in fish notwithstanding the most favourable conditions for reproduction—and there can be no doubt that this is due to abuses or the bad system of fishing practised by all countries which border on the sea. In the first place the means of extraction are greater, as the condition of these waters and that of the bottoms is more conducive to the establishment of impediments to fish passage than to trawling, also that the Mediterranean is more suitable to certain species. Notwithstanding this, its temperature, the class of vegetation which flourishes on its bottom, and the material organism which it constantly receives from the rivers and rainy deposits, are other elements which favour a large production.

PROPOSALS.

I will conclude by making some proposals to my colleagues the Commissioners of all the countries represented at this Exhibition.

The importance of fisheries as the source of wealth is now recognised by all civilised countries, nor is it forgotten that it forms one of the principal elements in the public food supply, as well as that their extension facilitates the means of communication among nations, and that this increases the industrial output; and lastly, that the calling of a fisherman is the nursery which produces that race, hardy, enduring, and brave, which man our ships, establish means of communication among continents, and maintain the independence of nations.

All are interested individually and collectively in this calling and in the rational protection of the industry, because nature has provided no frontiers for the watery inhabitants, and the immensity in which they live manifests eloquently the interest which ought to be taken by nations to maintain this richness of production.

It is necessary for this that men of all countries who devote themselves to the study and administration of the different branches constituting this industry, should communicate one with the other to compare observations, resolve their doubts, and give statistics; it is necessary, too, that they should follow the example of England and seize an occasion to facilitate the interchange of products of all countries concerned; and it is necessary, lastly, that congresses should be held at which may be elucidated technically all points of controversy, thus founding a basis for international treaties.

Spain has established fishery boards in all her maritime provinces, and the Administration of these in the Ministry of Marine will gladly enter into relations with all the Commissions now established, or to be established, for the mutual interchange of matters tending to facilitate a knowledge of this important industry.

This community of interests is more apparent among nations of the same continent, since in the exercise of fishing, interests are affected in a reciprocal way, in the case of emigrants or passengers along the shore, and even the sedentary coast inhabitants. Many practical examples could be cited of common injuries, but I will limit myself to one.

The French fishermen used to fish in free waters off Arcachon with a trawling-net which they call "chalut," and the places they dragged they thought to be a bank or natural bed of sea bream and other shore species. Seeing that in Spain there was a diminution of these species, the

Spanish fishermen went to work also (as the place was equally free to both nations,) destroying the means of production of those species, which would naturally tend to seek another place farther off, with an appreciable loss to both Spaniards and Frenchmen.

It is necessary, therefore, that we should endeavour, considering the universal interests involved, to recommend in our respective countries the necessity of coming to an agreement by means of international treaties, so that the abuse of one nation may not prejudice the others.

It is evident that it is an error to consider the boundaries of national waters as the measure of international jurisdiction, because fish cannot be made to respect these limitations, which only apply to other matters, and more space is required in order that the bordering nations may watch over their preservation, not abandoning it as they do now by reason of this small territorial limit.

I will conclude with a point of great importance. We are all deeply impressed with the sufferings to which the fisherman is subject in his precarious occupation, ending in many cases in an untimely death ; and as we have already said the waters have no frontiers, neither have human sentiments. It follows then that all coasting nations may afford protection from some of the sailor's perils by means of benevolent societies, giving relief in cases of shipwreck and in any other disasters contracted in the calling.

All nations should combine for the mutual aid and propagation of societies of this nature, by means of which the man, well-to-do and exempt from perils, fulfils one of his most sacred duties—the relief of the poor hardly-worked fisherman.

At the conclusion of the Paper, the CHAIRMAN said it had been considered wiser to defer the discussion upon it, as a great many of the foreign delegates were absent, having gone to Scotland to inspect Sir James Maitland's fish culture arrangements at Stirling. He would therefore only propose a vote of thanks to Lieut.-Colonel Solá for his Paper.

The vote of thanks having been passed,

Mr. BIRKBECK, M.P., moved a similar vote to his Excellency for presiding, which was carried unanimously, and the Conference then adjourned.

FOREST PROTECTION

AND

TREE CULTURE ON WATER FRONTAGES

WITH THE VIEW OF

PROVIDING A CONSTANT AND STEADY SUPPLY
OF WATER, FOOD, SHADE, AND SHELTER,
FOR FRESHWATER FISH.

BY

D HOWITZ, Esq.,

FOREST CONSERVATOR, COMMISSIONER FOR DENMARK TO THE
INTERNATIONAL FISHERIES EXHIBITION, 1883.

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CONFERENCE ON WEDNESDAY, JULY 18, 1883.

HIS Excellency M. DE FALBE took the chair, when the following paper was read by Mr. HOWITZ on

FOREST PROTECTION AND TREE CULTURE ON WATER FRONTAGES, WITH THE VIEW OF PROVIDING A CONSTANT AND STEADY SUPPLY OF WATER, FOOD, SHADE, AND SHELTER FOR FRESHWATER FISH.

THE questions of pisciculture, its protection, and the protection of fisheries have been already discussed by so many able and learned gentlemen, that I should not have ventured to come forward if there had not presented itself to my mind a question in which I, as a professional forester, have a great interest, and one which I feel is of much importance to the success of pisciculture and to all freshwater fishing.

The value of the question which I have the honour to bring before you may not at first appear so great as it really is, but, while endeavouring to enlist your sympathies, I do so in the sincere hope that by the introduction of it at this Conference it may become a question of interest to all and a special subject for future legislation. It is the question of the protection, proper management, and cultivation of forests and forest trees in localities where are found the sources of creeks, rivers, and the supply of water to lakes and other fresh waters.

For Great Britain this question has its greatest significance with regard to future forest culture on barren heights and the cultivation of shade and shelter trees along watercourses. The greatest part of the forest land with which our question has to deal is in the possession of large landowners, but as far as I can ascertain there are no laws in existence giving a guarantee for the preservation and proper management of these forests. Far more importance has this question for the British Colonies, America, and several other countries, where either the State, a number of persons, and in some cases nobody, owns the land in question.

That the forests regulate the flow of the water in watercourses, and ensure a steady supply during dry seasons, while they prevent sudden and disastrous floods, is a fact so often discussed and proved, that I need only refer to it here.

That the forests also increase the rainfall has often been disputed, and this question has of late years received considerable attention, particularly in France, but there is still a great deal of uncertainty about the exact extent of the effect of a forest on the rainfall, and it is only by very minute observations of forests, consisting of the same species of trees in various altitudes, that series of trustworthy results can be attained. Still there is no longer any doubt as to the effect of the forest in conserving the water that falls, or that the humidity of the air above a forest is considerably larger than that of the air of the open country. Experiments in the South of France showed that the rainfall in a forest as compared with that in the open country was in the proportion of 100 to 92·5, while the evaporation in the forest was only one-third of the evaporation in the open. The result of this is that the actual water received and retained from the atmosphere is nearly fifty per cent. greater in a forest than that received and retained by the plains. Numerous observations have also established the fact that the forests, as ready conductors of electricity, influence the current of vapours, and that their action is felt far above the actual height of the trees. Also that they condense the clouds into rain by lowering the temperature, and act as bulwarks against the severity of storms ; all this we know by daily experience and observation. That want of forest protection may have most fearful results has been so often and sadly proved, and I need only remind you of the disasters caused by great floods and long droughts in Spain, South of France, Sicily, Chili, Peru, Mauritius, and many other places, and you will grant the importance of the question. In the Murcia valley the river was reduced to a succession of stagnant pools, which during the summer heat developed malaria, fever, and miasmatic exhalations, detrimental to life and health, and furnishing but scant and bad accommodation for the few remaining fish. But as soon as the winter rains came, the river, in fact nearly all the valley, became a raging torrent, destroying life and property, and all because the forests on the ranges and mountains had been devastated, no legal restrictions protecting them. As a question of national economy, as a question of protection to life and property, and as a question of prosperity, forest protection has therefore the greatest claim to the attention of the Legislature. But to us as a means of yielding a constant suppiy of water, food, and shelter for the fishes, it has also great significance. The forest, with its numberless roots and decaying vegetation, retains the rain water and prevents it from rushing to the rivers and the sea, while it gives it off to these slowly and steadily. It acts like a great sieve and retains the fine particles of the soil, which the influence of the air and sun, the frost and rain, and the action of the numberless roots have decomposed, thereby fertilising the land and forming a layer of mould or humus, in which insects, worms, larvæ, and other animalcules live and breed.

In his most interesting paper on fish diseases, Prof. Huxley said that drought or flood did not seem to affect the *Saprolegnia*, but that a steady flow was beneficial to the fish.

Mr. Wilmot, in the following discussion, pointed out that the disease nearly always appeared where the regularity of the supply of water had been disturbed by the destruction of the forests.

I presume, therefore, that both these learned and practical gentlemen will agree with me in the importance of the forest protection as a means of preserving the health of the fishes.

The branchlets, leaves, decaying and decayed vegetation, produce a vast amount of nourishment for the fish, and one most agreeable to them. Each breeze drops into the water numberless grubs, caterpillars, beetles, flies, and other insects, the food most relished by the fishes, while from the banks and roots worms and grubs are constantly supplying them with delicacies.

The shade of the overhanging trees is also agreeable to the fish, and one needs only place a board in a stream and see the fish gather underneath it to be convinced of this. We all know that a shady deep pool is a good place in which to seek for fish, and have often observed the predilection fish have for the shady side of a stream. But not only as regards freshwater fishing can this be said. In Denmark it is a well-known fact that the best fishing is where a forest is close to the shore, and in particular where the trees, as is often the case in that country, overhang the very sea. The shadowing trees have another and, perhaps, the far more important effect of preventing a large evaporation, and at the same time keeping the water clear and cool in summer, while on the same account the winter frosts do not deal so severely with them. In all forest country the changes of temperature are not so severely felt as in a treeless country or on the open plains, and the effect upon the water is even greater. It is a popular saying in Denmark of the forest streams, that they are cool in the summer and warm in the winter, this, of course, meaning that they present that feeling in comparison to the atmosphere. The forests not only regulate the flow of the water, but they purify the water. This is an experience often demonstrated in Australia in cases where streams have been polluted by wool-washing establishments. After having passed a few miles through a shady and dense forest the water will appear as clear and pure as it was above the woolwash.

I need not here enter upon more reasons for the conservation of existing forests to ensure a steady supply or to draw your attention to the danger in not protecting them by legislation. But I will draw your attention to the advisability of cultivating forests on places suitable for the supply of water, and especially along watercourses and lakes as means of purifying these, preventing too great evaporation, supplying food for fish, and providing these with shade against the rays of the summer sun, and shelter from the pelting rains, the hail and the tempests.

Salmon fishing and all freshwater fishing depend upon proper attention to this matter, and I feel certain that if the true causes were properly investigated where fish were said to disappear from a stream, in half the cases it would be found that the shade and shelter of the forests or protecting border trees had been taken away. It was said at the reading of Sir James Gibson Maitland's excellent paper on the "Salmonidæ," that it was not enough to place spawn and fry in a water, they must be provided with proper food, and the best means to do this is to preserve the border trees and ensure a steady supply of water and food by preserving the forests from whence the supply of water is derived. But, as before remarked, it is not enough to preserve the present forest. New forest must be cultivated on the barren ranges, and many a stream, now nearly empty during dry seasons, will be re-filled and soon teem with fish and food for the many. So far for the principle of the conservation of the forest. I will now briefly mention the most suitable trees and their culture. But before entering upon this, I must draw your attention to the important condition to be observed in the management of such forest areas, as are preserved for the sake of conservation of water. *This condition is density.* In the dense shade of a well-closed forest are developed all those atmospheric conditions on which depend the greatest effects of the forest in regard to climate and water conservation. The so-called periodical thinning out in these areas should be carried on with the greatest care, and might with advantage be nearly dispensed with, if the economy of the management would permit it. The result would be, besides the effect upon the water conservation, that tall straight trees would be reared, yielding timber most valuable for all practical purposes. Nature itself would do the thinning out, and do it in a better way than we could hope to do, while the ground would be kept moist and in a state favourable to the decomposition of vegetable matter. It is desirable therefore to frame regulations regarding such forests, deciding the minimum to be preserved of the number of trees per acre, due regard being of course paid to age, species, altitude, and locality. For these reasons it is highly important that *all such forests*, whether private property, commons, or belonging to the State, *should be placed under the control of the State.*

The different trees have naturally a different effect as regards conservation of water and production of food and shelter for fish, as I will here briefly point out. To simplify matters we may divide all forest trees into two large groups, the deciduous and the evergreen trees. The deciduous trees, of which, as far as Great Britain is concerned, the oak, elm, beech, plane, larch, willow, and poplar are the most prominent, have a decided advantage over the evergreens. I need not here enlarge upon the fact that the full shady foliage during the summer is far more effective in preventing a large evaporation, and that the branches of the trees of this group are more spreading than those of the other. The energy of life seems to be far greater in these trees towards effecting our objects, and for direct border trees to a watercourse they are undoubtedly the best suited. The great amount of foliage and branchlets yearly thrown by these trees forms a very prominent factor in the economy of nature, and their decaying vegetation is full of teeming life and food for fish.

That this group is eminently suited for water conservation, was illustrated in a forest in Denmark, where an area of firs and pines was cultivated with beech and oak. After a lapse of about fifteen years a millstream, which during the time of the evergreen trees had dwindled down considerably, assumed such proportions that the irrigation of a considerable area was effected by it, besides supplying the mill with abundance of water. As regards the evergreen trees, the first cultivation of barren ranges or high plateaus might advantageously be undertaken with these on account of their ability to resist the severity of the climate in those exposed localities, and to grow on stony and poor soil. But even on rocky ground and in high altitudes the larches, birches, and other deciduous trees will often do well and serve better for the end which we have in view, the water storage and the pisciculture.

In such localities, where only the most hardy trees can be reared, it would be practical to cultivate along the watercourses, in the valleys and ravines, or any lower ground, a few rows of deciduous trees as soon as the other trees had attained sufficient height to protect them from the storms and the frosts. Several objects may be gained by doing so. First, the shade, shelter, and other beneficial effects for the fishes; secondly, that more valuable timber could be reared, as these trees have, as a rule, a greater preference for damp and moist localities than the evergreens; and, thirdly, because the deciduous trees permit more freely a luxuriant undergrowth of shrubs and annuals. All freshwater fishermen will agree with me in the advantage of having a good growth of annuals as watercresses, nettles, &c., near the bank, and have observed that during feeding time the fish always seek such places. There is a vast variety of shrubs and annuals, that might easily and with great advantage be introduced and grown on the river banks, but it would be outside the bounds of this paper to enter fully on the theme. However, I may only mention that many fodder plants and grasses from other countries might be a source of wealth to the population, and greatly benefit the fish as well as the owners of the land, if cultivated on the banks. The Prickly Comfrey, e.g. (*Symphytum asperrimum*), which yields such a splendid forage by its abundant foliage, and many others, are easily reared both from seed and cuttings, and should do well in the low lands, while on the sandy beaches, near the outlet of rivers and creeks, the cabbage radish (*Pringlea antiscorbutica*) would cover these barren and desolate places with vegetation, and furnish an object of merchandise by packing them for the use of fishermen and sailors in the Arctic regions. The plant when cooked is a good substitute for cabbage, and has a most wholesome effect on persons suffering from scorbutica.

By a judicious forest management, which I will not enter upon here, the land can be kept covered constantly, and always in a state favourable to the purpose of storing the water. That many of the evergreen trees may be of great importance, and particularly where they are better suited to clime and soil, I will not deny. The Australian eucalypts, which have such a beneficial effect on the health of man, may also serve well for pisciculture, but as far as I know, no experience is yet at hand with regard to this. Still I doubt if these trees might not do more harm than good by being planted on watercourses, on account of their great drying properties. In warmer countries, the place for these trees is where stagnant waters during summer are breeding places for fever and ague. The cultivation of the borders of watercourses has also a great significance to us, and it is here that the deciduous trees must be mainly utilised. The belt need not be very broad, say half a chain wide, and planted with good-sized plants at the rate of from 800 to 2000 per acre, according to their age. Even a double row of trees would be a benefit, but it is important that both sides of the stream should be planted instead of cultivating twice the distance on one side. This being done with the object of providing a perfect shelter in some place, and valuable observations may be obtained by doing so. A great many American and other foreign trees might well be introduced, as, for example, the Swamp Cypress (*Taxodium distichum*), a great tree yielding a finely-grained timber, hard and durable, and the Leverwood tree (*Ostrya Virginica*), which besides excellent timber furnishes a relished forage from its rich foliage; these, and a great many more, might have a good effect on the river fishing besides other advantages. But it is particularly the willows to which our attention should be drawn. The preference which these trees have for water, and particularly for running water, is well known, and points directly to the practicability of placing them in those localities so well suited for them. The fish like willows, and I have often times in Australia seen the best fishing places close to where some weeping willows (*Salix Babylonica*) had taken the place of the indigenous and even more shady wattles (*acacias*).

The yearly consumption of osiers in England is far greater than the national supply, and as the basket industry is constantly on the increase, it would also on this account be advisable to further the cultivation of the osier willows. For light, sandy banks, the best willow should be *Salix Purpurea*, and, as it is so easily propagated, it will well repay the cost of cultivation, besides binding the banks, making them firm, and adding to the health of the locality as well as that of the water. For more clayey soil, *S. viminalis* and the now celebrated *S. capræa*, so much sought for powder factories, should be the best. The cuttings must be taken from the one to two year old shoots, and be put 1 to 1½ foot apart, in double or treble rows 2 to 3 feet apart, care being taken to leave only ½ inch or less above ground.

There are many localities where comparatively valueless land, close to the mouths of rivers and canals, might be made highly profitable, at the same time as the cultivation of it with the before-mentioned trees and plants would improve the state of the fishing, and, before placing spawn and fish in any water, I consider it important to pay great attention to this question. Where few or no trees exist it will be necessary to cultivate them, and I feel certain that such proceeding will enhance the chances of the success of pisciculture. I will not here enter further upon the practical details of the question. These are bound to vary with the locality, and the local foresters will know how to deal with them.

In drawing the attention of the Conference to this question, it is with the sincere hope that it may enlist your sympathy, and that the public opinion may be won for it. That it is important for all freshwater fishing is evident. That is one more reason added to the many why we should regard the forest as a precious heirloom to be deeply revered, properly used, and, through careful maintenance, descend improved and enriched to posterity.

DISCUSSION.

Professor BROWN GOODE moved a vote of thanks to the Danish Commissioner for the Paper. He had already that day, in speaking on Professor Lankester's paper, called attention to the fact that one of the most important results of the Exhibition was its scientific results, important among which are the Conference Papers which have been read. This was confirmed by the present paper, which touched on an entirely new question. Hitherto the literature of fish culture had contained no allusion to forest culture: at the same time it was a subject of great importance, and every fish culturist would see the bearing of it at once. Mr. Howitz had pointed out this fact, and had given them the benefit of his practical experience as a forester in Australia, and while engaged by the French Government in the forest service in Algiers. He considered that this paper would be received with great interest by his own countrymen, because in the United States, more than in any part of Europe, had the destruction of forests taken place. Many streams which formerly had a steady flow of water were now dried up in summer, and torrents in winter, while many kinds of fish which once teemed in them were now almost extinct.

Major SEWELL-GANA seconded the motion, which was carried unanimously.

The MARQUIS OF HAMILTON proposed a vote of thanks to his Excellency the Danish Minister for so kindly presiding over the meeting. He regretted the attendance had been somewhat small, but it must be a matter for congratulation to Mr. Howitz that his paper had been so thoroughly appreciated by the United States Commissioner. It was also a matter for congratulation to think that a gentleman of Danish nationality should be so kind as to come and preside on the present occasion, and that another Danish gentleman should be so good as to read this important paper, especially remembering that both were of the same race as the noble lady who was so much beloved in England—the Princess of Wales. His Excellency had taken great interest in the Exhibition from its commencement and it was owing to him and to Mr. Howitz that the Danish Court had been so amply filled.

Mr. WILMOT seconded the resolution. There was no doubt that this paper was of a novel character as connected with fish culture, for he was quite aware that it had not been discussed before in any public manner, but he might be pardoned for mentioning that on two or three occasions on sending reports to the Government of Canada he had expressed his views that the clearing of the forests had been one of the principal causes of the destruction of salmon in the Province of Ontario. He could speak from experience in the matter, on account of salmon being very numerous in a stream that ran through his property. Before the forests were cleared off, salmon and the better kinds of fishes were there in vast numbers, but as the trees were cleared off the water changed its temperature, it became less in quantity, and the consequence was they had lost all those valuable fish. He should not attribute it wholly to the want of trees, but that had been one of the principal agencies. Man, with his destructive engines, had of course aided by killing the parent fish when laying its eggs in those streams, but there was no doubt that the want of sufficient shade and coldness of the water for the fish to live and breed, was also an important element, because these higher breeds of fish were always found in cold waters. So important was it, that for the last two or three years he had set out a large number of trees round the pond where he was carrying on fish culture, and found it very beneficial, and he had often noticed the fish run underneath the shade of the trees on hot days, the temperature being lower there than out in the open stream. He had always contended that farming, forestry, and fish culture should go together, because one aided the other. Forestry aided agriculture, because if the whole forest was cut away the rainfall was interfered with, and agriculture was more or less affected. There were localities in Canada where forests had been wholly destroyed, where now they were unable to raise the same kind of grain as in former years; therefore it was evident that the total clearing of forests was injurious to agriculture. He was very glad that this paper had been read, because it would now be spread abroad and carry authority with it, and would no doubt do a vast deal of good. In his opinion, forests were useful in filtering the water which passed into the stream. The trees themselves filtered it, and so did the leaves on the ground, and the water was more pure than when it fell direct on the soil and ran straight into the river. There was no need to interfere with cultivated land, but rows of trees might be planted by the side of streams, which would not affect farming operations, and would conduce to the growth of fish. There was no doubt that the greater amount of forests on the face of the earth the greater the rainfall. Last year the legislature of the province of Ontario passed an Act incorporating a forestry association, the object of which was to set out trees for the benefit of the country, and preventing the destruction of those around the fields and along the sides of the roads.

The vote of thanks having been passed unanimously,

The CHAIRMAN said he had had much pleasure in taking the Chair, and he begged to acknowledge the kindness with which he had been received, not only there, but on every occasion since he had come to England as Danish Ambassador.

LINE FISHING.

BY

C. M. MUNDAHL.

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CONFERENCE ON TUESDAY, JUNE 26, 1883.

MR. EDWARD HENEAGE, M.P., occupied the chair.

LINE FISHING.

BY the courtesy of the promoters of this Exhibition I have been requested to read a paper on the subject of Line Fishing.

Whatever may be the imperfection of my remarks on the subject, I venture to speak to you as one who has for many years past paid some attention to the subject, and who has had a considerable range of experience, not only within the fishing grounds of the North Sea, but beyond the North Cape of Norway, on the great fishery of Finmarken, and the various other fisheries of that coast, and in another direction on those of Iceland and the Faroe Islands.

In order to avoid trespassing on the patience of my audience I have curtailed my remarks as much as possible. Very much more might be said, but then I do not claim that my paper will be exhaustive.

Line-fishing refers to the capture of fish by line and hook. It is divided into two systems:—1st, *Long-line* fishing, which implies a continuous length of line with hooks attached on smaller lines of about three feet length at intervals of about ten feet. Such a line may extend for a distance of several miles, and have upon it 5,000 or 6,000 hooks. It is secured on the ground by an anchor at each end and at intervals of about every half a mile. From the point of each of these anchors a buoy-line rises to the surface of the sea, where it is attached to a buoy. The buoy carries a flag from a staff about ten feet in height, and may be seen for a distance of two or three miles.

Hand-lining is the term used for a single line with a lead attached in order to sink it to the bottom, and from this lead two short lines, with a hook on each, are suspended. Such a line is worked by a man or boy from the vessel's deck, and as many as ten or twelve may be worked at the same time on each of the larger vessels, which are known as codmen.

Fishing by means of lines and hooks has been carried on for many centuries; mention is made of it in the Book of Isaiah, etc., but the subject of its antiquity has been treated at length in the elaborate paper read by the learned Professor at the inauguration of this series of Conferences, and it remains for me to deal with its practice in our own day.

So far as explorers have penetrated into regions far removed from the limits of civilization, wherever these are bordered by the ocean, they have found implements corresponding to our hooks and lines, and have furnished accounts which show that a considerable portion of the food supply of the untaught savage is obtained by the hook and line. Very interesting specimens of the crude fishing gear of the Esquimaux are exhibited in the United States section of this Exhibition; the hook is formed of two pieces of bone and the line is made of strips of sealskin, and although the hook is not furnished with the barb invariably found on the fish-hook of civilized people, yet I can well conceive that it is possible, where fish is plentiful, to procure a sufficiency even with a hook so clumsy.

While referring to this fact, it may be not uninteresting to notice the wide distance between civilized and uncivilized life denoted by the barb of the fish-hook. Probably centuries of use and observation lay between the first hook and the hook which by an advance of thought was furnished with a barb.

Line-fishing is carried on to a greater or less extent all round the coasts of the United Kingdom, but the most important fishing ground is found in the North Sea, and it is from this ocean that by far the larger quantity is brought to our markets.

Not only is Great Britain supplied from the rich harvest which these waters yield, but all the countries bordering on the North Sea draw their fish supply from the same locality, and carry on considerable commerce in the various kinds of fish.

Taking into account the area of the North Sea, and the number of people supplied with food from it, as well as the great variety of fish found therein, it may be regarded as the most important fishing ground in the world. Taking a line eastward from the Shetland Isles and continuing southward to the North Foreland, from shore to shore, whether on its shallows or in its depths, on its even grounds or in its caverns—which the fishermen call pits, or holes—fish of some kind or other is found in greater or less quantity. The variety consists of cod, ling, haddock, halibut, coal-fish, whiting, skate : these are the principal kinds caught on line, while almost every other kind which supplies the table of rich or poor is caught in the trawl or in the drift-net.

The other large grounds are the Bank of Newfoundland, the great fisheries of Lofoden and Finmarken on the coast of Norway, and Iceland and the Faroe Islands.

So far as information can be gathered on the question, it appears that as early as the beginning of the present century the English and Scotch were already taking the greatest advantage of the fisheries of the North Sea ; the Dutch were the only other people who prosecuted deep sea fishing to any extent, but these, although holding a prominent position in the line fishery of the North Sea, and notwithstanding that their method of fishing is of the very best, yet in the number and tonnage of their vessels, or in the number of men employed, they have been left far behind in the race of competition.

The French have only within the last ten years made their appearance as line-fishers in the North Sea ; on the other hand they prosecute on a large scale the fisheries of Newfoundland and those of Iceland, the latter of which I shall take occasion to refer to before I conclude.

Belgium sends a few vessels to the hand-line fishing in the North Sea, but these vessels are small and inferior, and do not compare with the craft of either England or Holland engaged in the same trade. They fish for cod, most of which is salted in barrels for home consumption, and in this particular branch they certainly succeed in producing a very superior quality.

Holland, as already remarked, takes a prominent part in the line-fishing of the North Sea. Besides having a fleet of several hundred open boats and vessels of small size, which fish with lines along shore when circumstances permit, they have a fleet of some fifty vessels or more sailing from the fishing ports of Perniss, Middleharniss, Zwartewaal, Vlaardingen and Maasluis.

Nearly the whole of this fleet consists of vessels of a modern class, which have supplanted the old Dutch hooker of primitive shape, with its great square sail. They are constructed with wells for the keeping of the fish alive, and generally during the summer months carry ice, with which they preserve the dead fish of their cargo. They bring about one-half of their winter's catch to the English market, making Grimsby their *rendezvous*; another considerable portion of the catch is disposed of in Belgium.

During the summer months a number of this fleet is occupied in the herring fishery, another part in the haddock fishery, and the remainder in the hand-line fishery for cod in the northern latitudes of the North Sea. At this season of the year, instead of keeping their catch alive, they salt it in barrels and land it at Vlaardingen, which is the great Dutch market for this article. From this place it is distributed, partly to other Dutch markets, but chiefly to Belgium.

Germany does not put in an appearance at all on the high seas. I am aware that small fleets of fishing boats sail from Blankenese, principally, and from other points down to Cuxhaven on the Elbe, and a few from the rivers Weser and Jahde, but they seldom venture beyond Heligoland Deep, and indeed few of them, if any, come within the branch of line-fishing.

It is a matter of surprise, and one that may be worthy the notice of His Excellency the German Ambassador, who appears to take an active interest in the present Exhibition, that so great a nation as Germany, and a people so energetic in all commercial life, should prefer to go abroad for a considerable portion of their fish supply, when they might profitably occupy in the trade a considerable number of the population, and by such means become their own purveyors.

Denmark finds a supply of fish along the shores of Jutland, in the Kattegat and the Belts ; their line-fishing is confined to these waters, and is prosecuted with vessels of small tonnage and by open boats. They make no attempts to supply other nations, and on the other hand they do not need to purchase to any great extent from abroad.

Sweden sends a large fleet of fishing vessels to the line-fishing in the North Sea. Their vessels are not attractive in appearance ; having a keel short in proportion to the length over all, they present a rather unsightly picture, but are constructed with a view of riding at anchor in the open sea. They are probably the best model for such a purpose.

They are usually manned with twelve hands. The vessels are mostly laid up during the winter months from November to March, and for the rest of the year they are occupied principally in long-line fishing between the latitudes of 57° and 63° N. They carry on their operations along the edge of the great bank which runs along the deep-water channel fronting the Norwegian coast, and is commonly known as the Reef; but several of them have of late years moved westwardly to within fifty miles of the north of Scotland.

Their practice is to place their lines on sloping ground, from a less to a greater depth of the sea, sometimes to as much as 200 fathoms, a depth so considerable that almost all other fishermen shrink from the severe labour entailed in hauling them in again. The hardy Swede, however, appears to take it all as a matter of course, and is frequently rewarded for his toil by immense catches of ling and other kinds of fish.

I am informed on reliable authority that as many as a thousand ling have been taken in one day; reckoning a ling at an average of 24 lbs. this represents nearly 10½ tons of ling, besides cod and other kinds of fish, of which they catch a fair proportion. These quantities are perhaps not equalled by any fishermen in the North Sea, and can only be approached in their quantity by the Norwegian fishermen at the great periodical fisheries of Lofoden, Finmarken, and Romsdal.

The bait used by the Swedish fishermen is in the first instance the mussel. With these they bait their haddock line, which they work on banks adjacent to their great fishing grounds, where the haddock is found in large quantities; after a day's catch of haddock they sail away into deeper waters, and then in its turn the shiny haddock is cut up to make bait for the ling and cod, so carrying out the law of the survival of the fittest.

A specialty of the Swedish fishing lines is the float used on the snood. This is made of cedar bark cut to shape, about three inches long by one inch in diameter, and boiled in beeswax in order to render it impervious to water; it is so attached with respect to the hook as to keep the latter about two feet from the ground. Like the swinging signboard of a country inn, it makes a display which the hungry traveller cannot well resist, and as a consequence it is readily snapped at. It also serves the purpose of keeping the bait off the dirty ground and above the reach of the star-fish and creeping insects which infest large portions of the bottom of the sea.

The position held by Norwegian fisheries is by far the most important both as regards the number of persons employed and the quantities landed. But inasmuch as their great fisheries are localised and carried on within the limits of their own coasts, and as they have been already referred to by Professor Huxley, I will only briefly notice them.

Their boats are almost exclusively open, and of a small size compared with the usual fishing vessel for the open sea. Their lines and hooks are about the same as those used by our own smacks, the principle of working them is also nearly the same, with this exception, that whereas the immense shoals of cod on their journey to the coast do not always take the ground—as the term is—but move at a greater or less depth, they ascertain the position of the fish in the sea, and then instead of sinking their line to the bottom they suspend it in mid-water by means of glass globes which they attach to their line. Specimens of these glass globes may be seen in the splendid collection of the Norwegian department. I am not aware that this system is used by any other fishermen, but it recommends itself as a very ingenious and successful method, and as a proof of its utility I may remark that instances have come under my notice in which on a line of 3000 hooks, so suspended, 2000 fish have been taken in one haul, while neighbouring boats whose lines have been set at a greater depth have drawn almost a blank.

Some attempts have been made of late years by the Norwegians to take a part in the open sea fisheries, and I regret to say they have not been so successful as they deserve. I venture, however, to express the opinion that as a people they possess too much energy and enterprise to be baffled by a few fruitless attempts, and that by perseverance they will succeed. A people so hardy, and by constant practice so inured to the hardships and dangers of the sea, is eminently qualified to take a prominent position in this direction. Having so far briefly considered the position of our friends and neighbours as regards the subject of my address I will pass on to notice our home line-fishing.

I have already referred to the fact that line-fishing is carried on more or less all round our coast. There is scarcely a village or a hamlet on the east coast of England and Scotland without its fishermen. The beach boat, yawl, coble and other open boats that venture out from along the English and Scotch coasts when weather and other circumstances permit, to work their lines, may be counted by hundreds. But, as His Royal Highness the Duke of Edinburgh has remarked in his admirable paper, "the term fisherman is a somewhat elastic one," and the occupations of persons who style themselves fishermen are of such varied character that we must leave these in order to deal with that class whose sole occupation is fishing and who make this calling the business of their life.

Before the railway system had grown to anything like its present proportion the small town of Barking in Essex was the great fishing centre of England. Being near to London and on the Thames its situation was a most convenient one for the fishermen who made it their business to supply the Metropolis with fish. Nearly fifty years ago a fleet of about 200 decked vessels sailed from this place, and the trade was considerably developed as regards the size and construction of their vessels and the efficiency of the men themselves. Still their smacks were small compared with those of the present day; most of them were under forty tons register. These vessels were adapted both for lining and trawling, and were alternately occupied in each trade. The remainder of the lining fleet was made up from Greenwich, Harwich, Gravesend, Aldborough, Blackwall and Deptford. They used to go to the Dogger Bank during the winter months, and worked with long-lines; during the summer months some of them fished with hand-lines on the north coast of Scotland, some of them were occupied in carrying lobsters from Norway and Sweden to the London market, and others were engaged in the whiting and haddock fishing. They all used to bring their live cargoes to Gravesend and thence sent them forward from day to day to Billingsgate market.

In the year 1851 the Manchester, Sheffield and Lincolnshire Railway Company had completed their magnificent new docks and line at Grimsby; and the direct connection established by this rail with London and the great provincial centres, together with the geographical position of the port with regard to the great fishing banks, recommended it as the most convenient fishing centre on the east coast.

Smack owners from Harwich, Greenwich and Barking commenced to send their vessels here periodically; a company in connection with the Manchester, Sheffield, and Lincolnshire Railway Company was formed, and for some years employed twelve smacks—one half the number in the lining, and the other half in the trawling business. A market and a dock for the special use of the fish trade were constructed in 1855; and so rapid has been the growth of the trade from that time to the present day that the efforts of the railway company in extending the dock accommodation have hardly been able to keep pace with the increasing trade.

I have not been able strictly to arrive at the relative figures of tonnage, but I shall not be far from the fact, and perhaps near enough for the purpose of this paper, if I compute the tonnage of all fishing vessels in Grimsby in 1855 at 800 tons, half of which were cod smacks. At present the tonnage actually belonging to the port is not far short of 40,000, 8000 tons of which is represented by about 120 cod smacks, while most of the cod vessels from Greenwich, Harwich, and also from Holland, trade here regularly during the long-line season. The population of Grimsby has during the same period increased from 10,000 to about 40,000.

This great development of the line-fishing at Grimsby has not been without its effect on the other fishing towns which I have named. Barking and some of the other places referred to have retired from the trade altogether, and Greenwich and Harwich are now the only other places from which cod vessels take part in the line-fishing, and that only to a small extent.

A number of yawls or luggers from Filey, Scarborough, Hartlepool, and the Tyne, engage in deep sea lining during the spring of the year, but they are not vessels with wells, and can only be said to be partly engaged in the trade.

A cod smack is a fore-and-aft dandy rigged vessel, with foremast and mizen-mast. Those built of late years vary from seventy to eighty-five tons, and we have some of over 120 tons register. The usual dimensions are sixty-five to seventy feet length of keel, twenty to twenty-one feet beam, and eleven feet to eleven feet six inches depth amidships; in ordinary ballast trim they draw about eleven feet of water aft, and from seven to seven and a half feet forward. They are as a rule fast sailers, and their seagoing qualities cannot be surpassed. I make no doubt that Christopher Columbus and Captain Cook would have rejoiced to have had such vessels for their expeditions. They are built principally of oak, and fitted with cabin and forcastle; the master and five men occupy the cabin, and four to six boys the forecastle.

In the centre of the vessel a space of nearly one third of the length of the keel is set apart for the well; this is divided off by strong bulkheads, or well-heads as they are termed, of oak twelve to fourteen inches thick; the space so set apart is again divided by one or two sectional bulkheads, thus forming two or three wells, as the case may be. These well-heads are carried upwards for about half the entire height of the vessel, or about five feet six inches, a strong oak deck is then laid over all from the fore to the aft well-head, forming what in a merchant ship would be called 'tween decks, and on board smacks is styled a well deck. From the centre of the well deck a strongly encased watertight hatchway called a well funnel rises to the upper deck. The bottom of the well is planked over in the same way as the rest of the vessel outside, in the planks well-holes are bored about fifteen inches apart, and through these the water is admitted into the well, and by the motion of the vessel when at sea is freely circulated. Above the well deck and in the after part of the vessel's hold, the space is used for an ice room, where about eight tons of ice is stowed, and compartments made for the stowage of the fish which die on the voyage. The fore part of the vessel's hold is used for spare sails and the fishing gear. The smack carries with it a boat about twenty feet in length, six feet four inches in width, and three feet in depth. Very frequently this boat is used for hauling the lines at sea, and when the winter gales carry destruction to the ships in the North Sea, the English fisherman is never slow in launching his boat and risking his own life in order to save his fellow. Never a winter goes by without numerous instances of this kind taking place, in many cases without reward or even notice being bestowed, in others they are duly acknowledged.

The bait formerly used by the codmen was whelks, but for the last twelve years this has been varied with lampreys and herrings, when obtainable, according to the season of the year, and the fishing grounds where their operations have been carried on. During the summer months, whelks and herrings are now used, and from October to April, lampreys and whelks by the vessels that go to the Dogger and the Great Fishery Banks, but whelks only by the vessels that fish on the grounds nearer home.

The cost of bait is a considerable item in the outfit of a cod smack, amounting to from twelve to twenty pounds per voyage. Ice is another item, which may be put as from seven pounds to ten pounds per voyage, and these, together with wages and food for the crew, harbour dues and other requirements, bring the current expenses of a smack up to about thirty pounds weekly, without any allowance for wear and tear, insurance or interest on capital invested.

The vessels are insured in local mutual insurance societies against total and partial loss up to a sum representing from one half to two-thirds of their value, and the yearly cost of assurance seldom exceeds two and a half per cent. of amount assured. A smack such as I have described of about eighty tons register costs ready for sea from £1,600 to £1,800.

Previous to 1862 the long-line operations never extended beyond the Dogger Bank. But since then they have year after year been carried further northerly and easterly, and at the present time the whole area from Shetland southwards is fished upon.

As soon as the vessel arrives on the fishing ground, the lines are got ready, and the hooks baited. Where whelks are used as bait, the shells are broken with a mallet, the snail is sorted out, and carefully put on the hook. If lamprey or herrings are used, they are cut into small slices and so put on the hook. A curious fact with regard to this kind of bait is, that cod, haddock, or ling will seldom or ever accept the tail-piece of either lamprey or herring. The skate however is not so particular with regard to the joint.

The lines are coiled into a tray made of wood, usually 480 fathoms in each, and the hooks are placed with careful regularity in rows on the bottom of the tray. About two or three hours before sunrise the lines are laid out. The end of the line is attached to an anchor, which is secured to a buoy-line and buoy, the vessel is steered away, usually to the wind or close hauled, and one of the men "pays out" or "shoots" the line, as it is termed, while the rest attend to the anchors and buoys. When the whole length of line is out, it is allowed to remain two or three hours, and then the hauling commences. As soon as a cod or ling is caught it is carefully pierced under the fin on the right side, in order that the air with which the belly of the fish is inflated may escape. This operation, which is carried out in less time than I have used to relate it, being performed, the fish is dropped into the well. The cod and haddock are usually allowed to swim about free, the ling and halibut are suspended by their tails, and so confined they are found to live longer.

A day's catch may vary from twenty cod or even less, to three or four hundred cod and ling, and proportionate quantities of haddock and other fish. The vessel usually returns to port after an absence of from eight to twenty days; on its arrival the live fish are put into chests or trunks, which are kept afloat in the dock and adapted so that the water may circulate freely from without. The dead fish are landed in the market, and it is sold at once, being forwarded thence to all parts of England, Scotland, and even to Ireland.

During the summer months the greater number of the vessels go to the codfishing at Iceland and the Faroe Islands, where they fish with hand-lines. The fish caught here is salted during the first part of the voyage, and the fish so salted is generally sold to merchants in Shetland, who dry it and export it to the Spanish, Scotch, and Irish markets. During the latter part of this voyage they keep the best of their catch alive, and bring this proportion home at the close of their voyage.

I mentioned in the early part of my remarks that the French sent a considerable fleet to the Iceland fishery, and I wish to draw attention to the fact that the French Government send with this fishing fleet a corvette and a gunboat, whose duty it is to superintend and assist, and give *prestige* to their fishermen in those parts. Considering the number of British lives and the amount of British property employed in the same direction I venture to think that if our Government could be induced to send one of their smaller vessels of war to this coast during the fishing season it would be an act of service to British interests.

There is only one other point to which I beg to call your attention. On the nearest banks and along the shore of the east coast a large quantity of immature cod are caught, and I firmly believe, notwithstanding what we have heard from Professor Huxley on the subject, that this wholesale capture of the young will sooner or later affect our supply of cod on the home grounds.

My proposal is, that a law similar to that which protects the crab and the lobster should extend to all kinds of immature fish so far as it is possible to carry it out, and as the Board of Trade is very anxious to do something for the fishing trade, I would very respectfully suggest that it should take the young fish under its care, and establish one or more stations for the culture of those kinds of sea-fish which form such important part of the food supply of the nation.

DISCUSSION.

Sir EDWARD WATKIN proposed a vote of thanks to Mr. Mundahl for his very able paper. He said he did not do so as a mere matter of compliment, but because the paper really contained a great deal of instruction and information on a most interesting question. With regard to one of his remarks as to the course which the French Government had taken with regard to protecting and keeping order on the fishing grounds where French vessels were occupied, he must say that he had often wondered, seeing that Englishmen were more dependent on fishing than any other country, that our Government should have taken so little care to protect and keep order on the fishing grounds where our fishermen were employed. He could only explain the reason of the apparent indifference which was shown, by the fact that in many public departments the people who had to do the executive work were excessively ignorant. He did not know whether any one else present had been struck with it, and perhaps it would be rather out of order for him to make such a remark, but in this country we seemed to be getting every day more and more infested by those ignorant people who were always anxious to get official pay and employment. He had no doubt now that Mr. Mundahl had called attention to this matter, and that, generally speaking, owing to this Exhibition, public attention was being concentrated on the important question of our fisheries, there would be a little more courtesy and attention shown on the part of the Government, and that encouragement which the flag of England always gave would be afforded to those industrious men who risked their lives in an important and interesting calling, and that it would be found that some of our gunboats would be placed on important fishing grounds as a regular institution of the future. Mr. Mundahl had explained in the most graphic and interesting language the whole operation of line fishing, and no doubt there were many things which would be eminently suggestive to those who had listened to the paper. He had certainly taught him a great deal ; and no doubt every one, although they might be acquainted with the subject, would learn something. It was not always, even in these interesting discussions, that everything useful was to be learned, and nothing which had a contrary tendency ; he did not know whether it was the fault of the reporters, but he read the other day in the *Times* that at one of the previous Conferences it was laid down as a fact that the fishermen were a class of persons so very improvident and so very poor that they were always in debt. Whether that was so in other parts of the country he could not say, but with regard to the two great fishing districts he had been acquainted with, viz., Great Yarmouth and Grimsby, he did not think there was a more provident, saving, and God-fearing class all round than the fishermen of those two places, and he decidedly objected to its being put forward that they were so improvident that all the year round they must be in debt. Again, they were told on eminent authority that these men ought to put their money into saving banks and things of that kind, and ought never to enter into speculation by putting their money into the fishing industry with which they were connected. Now, his opinion was that the man who was connected with any industry which he liked, which he conducted with success, and which was the occupation of his life, could not do better than invest his savings in that industry. He was afraid that he had rather digressed from the first line of proposing a vote of thanks to Mr. Mundahl, but he could not help making these observations. The Chairman, the Hon. Member for Grimsby, and himself, with a number of others, were members of a Select Committee to consider the question of harbours, and that day before coming to the meeting he put a question to Mr. Stephenson, one of the most eminent of the Scotch engineers who built the harbours and lighthouses round the coast of Scotland, saying they had been told by Sir Thomas Boyd that since the improvement of the harbours of Scotland during the last forty years the fishing trade had doubled, and further that if they could only provide proper harbours round the Scotch coast the extension of the fishing industry was illimitable, and asked Mr. Stephenson his opinion upon it. His reply was, "Well, illimitable is a large word, but I do not think it is extreme. I think the whole question of the extension of fisheries in Scotland is a question of the improvement of harbours." Now, if that were so they knew exactly what was required, and he was quite certain that in that Committee they would have the candid support of the Honourable Members for Grimsby in favour of improving the harbours of England, Scotland, and Ireland as far and as fast as they could, with the view of improving this noble industry of fishing. There was only one other point he wished to mention, and that was this—it was not merely a question of catching fish, it was a question of the naval supremacy of this country, for if the fishing interest were abolished to-day where would be the navy the day after; if on the other hand by a judicious outlay of capital, everybody pulling together, and dropping all that nonsense about private enterprise, they could bring the force of opinion to bear in favour of the construction of great public works all round the coast, they would not only be securing a large increase of the fishing industry, but would also be increasing the supply of that grand human raw material which would defend our coasts against any enemy, and secure for ever the supremacy of England on the sea.

Mr. BIRKBECK, M.P., had great pleasure in seconding the motion. It was most gratifying to the Executive Committee that they had been so fortunate in the selection of the gentleman who had just read the paper on this very important industry, and felt sure that when the ultimate result of the Exhibition was collected, as he hoped it would be in a very formidable blue book, this paper would appear in it, and prove of very great interest. Personally he took great interest in this question, because from his boyhood upwards he had been over these very grounds to which Mr. Mundahl had referred, and perhaps even further; he had been up as far as Spitzbergen and seen shark fishing there. One of the most amusing incidents in connection with that fishing was this. When the smacks about the size Mr. Mundahl had referred to had commenced their fishing, sport was very bad for the first few days, because they had to get rid of the smaller sharks, and, rather than throw them overboard and let them sink down for the larger sharks to feed upon, they adopted the very ingenious plan of taking out their livers, introducing a pair of bellows, and, sewing up the shark's belly, let the fish float away with the tide, so that the larger sharks they wanted to catch would not prey on the smaller ones. He felt confident when this question of line fisheries was more prominently brought before the country that the application of capital to far more distant grounds would follow, and in that way the supply of fish would be largely increased. He begged to thank Mr. Mundahl on behalf of the Committee for his most excellent paper.

The CHAIRMAN, in putting the vote of thanks, said he naturally took the very greatest interest in the paper, not only for its own value, but on account of the gentleman who had read it, for being so essentially connected with Grimsby, everything to do with fishing and those engaged in it must have the deepest interest for him. He could not attempt to compete with the gentlemen who had already spoken in their knowledge of this subject. Sir Edward Watkin had, perhaps, in railway enterprise done more for fishing than any man living, the proof of which was shown by the statement given in the paper of the position of Grimsby with regard to fishing some twenty or thirty years ago compared with what it was now. If any further proof were required he would recommend any one to read the very excellent report of the Committee which sat last year on the condition of fishing lads and others engaged in the trade in England and Scotland. He entirely agreed with what had fallen from Sir Edward Watkin and Mr. Mundahl with regard to the way in which the fishing interest was neglected by public departments. He thought it was a disgrace that we had not with our large fleets a man-of-war or gunboat always at hand, not only to be a protection to boats when fishing, but also to be there ready to give assistance when those sudden squalls or gales came on which had done so much to make widows and orphans during the last two or three years. If a gunboat or a man-of-war had been on the spot in March last they would not now have been required to raise a large fund for the widows and orphans of Hull and Grimsby, which he regretted to say they were obliged to do now; at the same time he hoped that all would generously contribute to the relief of that which was almost a national calamity. With regard to what had been said by a learned gentleman in one of the previous papers as to the improvident character of fishermen, he ventured to say that facts entirely contradicted the statement. The matter came before him when working with the Board of Trade Committee, that a very large proportion indeed of those who entered as apprentices or seamen into this work rose to be some of the largest smack owners in England, and that being so, it could not be said that there was such great improvidence. They knew that in all classes there was improvidence, but why this fault should be charged upon fishermen in particular he had never been able to understand.

Earl **DUCIE** then moved a vote of thanks to the Chairman.

Mr. **MUNDAHL** said it afforded him very great pleasure to second the resolution. As a Grimsby man who had the honour of being represented by Mr. Heneage, it always gave him, as it did a large proportion of the Grimsby people, great pleasure to meet Mr. Heneage, because he was always so ready and willing to do anything he could for the benefit either of the fishing interest or the general interests of the town. Before sitting down he would take the liberty of saying, in response to the vote of thanks which had been passed, that the requests of the energetic and able Chairman of the Exhibition were always made with such geniality and courtesy that it afforded every one great pleasure at all times to comply with them. Personally he felt indebted to Mr. Birkbeck for the part he had taken in arranging this Exhibition. He had the greatest hope as to the fruits of it, and he was sure the nation would forget itself if it did not in some substantial way recognise the services of Mr. Birkbeck.

(The vote of thanks was carried unanimously, and briefly acknowledged by the Chairman.)

TRAWLING.

BY

ALFRED W. ANSELL.

> On the Dogger Bank in the cold North Sea,
> Wearily day and night toil we.
>
> —*Old Song.*

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CONFERENCE ON TUESDAY, JULY 24, 1883.

The EARL OF DUCIE in the Chair.

TRAWLING.

THE Beam-trawl is in most use amongst the English, French, and the Netherlands; and the trawling is prosecuted principally in the North Sea and around our coasts by craft of various description, rig and tonnage. There are also different modes of preserving the fish in a fresh state when caught, and in its conveyance to land and the markets for which it is intended; there is the inshore and the deep sea trawling.

The inshore trawling is prosecuted much in the same manner as the deep sea, but these do not go in fleets and the craft are necessarily smaller and the gear lighter, by them we have the bays and shallow parts of our coasts fished over, these craft using small mesh trawls doing great injury. Deep sea or Beam trawling as practised on our coasts has during the last century sprung from comparative insignificance to an important and increasing industry.* The rapid development of late years may be traced to the introduction of ice and the spread of our railway system, by which the catcher has been enabled to get the fruits of his toil distributed to the many thousands dwelling in the inland towns those who seldom or never saw or tasted salt water fish.

* Brixham claims to be the nursery of trawling in England.

As the difficulty of transit has been removed, and the means of getting fresh fish to the millions has been increased, so the trade has steadily increased, and now the commoner and more plentiful sorts of fish are transmitted in thousands of tons to starving labouring classes inland, supplying them with a good nutritious and wholesome meal at a moderate cost. But much more has yet to be done in this respect with the large supplies, now daily landed at the different fishing stations, affording an immense traffic to the several Railway Companies over whose lines the fish is conveyed. The question *must* come, nay, indeed, is *now* to the front, "Cannot this fish be carried at lower rates by the railways, and still be remunerative traffic?" I think so! The rates are excessively high in comparison with other commodities, and as the companies free themselves from any responsibility incurred by delays, through special agreement with the sender at lesser rates, it brings fish upon a level with other commodities that are carried; and there is a fair margin for a reduction in fish rates. And as there are also thousands of tons of the coarser kinds of fish which will *not* bear the high rate of carriage which are consequently wasted, there would, with *lower* rates, be increased traffic, which would be recuperative to the Companies.

There are thousands of tons of good wholesome food ready to be consumed, and millions of starving poor waiting for and wanting it! Think of that! If the poor *are* to have cheaper fish it must be through the railway companies reducing the rates.

The great Creator has given a bountiful supply, the catcher gets but poor reward for his labour, and is willing to take what will barely remunerate him for his toil, but the giant "High Railway Rate" bars the way, and says to the starving poor, you shall not partake of God's bounty.

RATES FROM HULL.

To	Fish (except prime). Per cwt. Owner's risk. s. d.	Fish (except prime). Per cwt. Company's risk. s. d.	Ripe Fruit. Per ton. £ s. d.	Old Potatoes, packed. Per ton. £ s. d.		Fresh Meat. Per ton. £ s. d.	
Leeds	1 6	1 11	15 0	7 11	2 tons lots	1 0 0	
Manchester . . .	1 9	2 2	1 10 0	12 1	4 „	1 15 0	at owner's risk.
Liverpool	2 0	2 6	1 16 8	12 6	„	1 11 8	
Birmingham . . .	2 3	2 10	1 12 6	15 10	„	2 3 4	
Glasgow	3 0	3 9	2 1 8	1 0 10	„	2 11 8	
London	(special) 1 6	1 11	2 10 0	15 10	„	2 0 0 2 10 0	exclusive of use of hampers and cloths. inclusive of do.

The number of British deep-sea trawlers may be taken at 3000 (not including steam-cutters), Yarmouth leading with 700, Hull and Grimsby next, making together about half the number, the rest being scattered around our coasts. Such smacks as sail from Yarmouth, Hull, and Grimsby, I class as the deep-sea trawler. Taking the average catch of each of these at 100 tons brings the total weight to 300,000 tons; irrespective of the inshore trawlers' catches, as some catch principally the coarse kinds in great quantity (as in the case of Hull and Grimsby, and also Messrs. Hewitts), and others *less* of coarse and *more* prime, we may take an estimate at £10 to £12 per ton as the price it fetches, this will give us a total money value of fish, caught by the deep sea trawler, of £3,000,000 at £10, or £3,600,000 at £12.

If we take capital employed in producing this at a total of £15,000,000, invested in floating and shore property, it is not over estimating it. We have ice ships, ice houses, steam carriers, curing houses, storing houses, and many other things too numerous to mention. The number of hands to man these vessels at 5 or 6 hands per ship (though some carry more) makes from 15 to 18,000; the latter is more like the number. To this we add 2000 who are out of berth by changing ships, we have then 20,000 hardy and experienced hands employed in deep sea trawling, and who have no *other calling* or *occupation.* Some of these have families, and calculating two only in each ship to be married, with each a wife and four children, we have 30,000 more who are *altogether dependent on the trawl for support.* But as the trade cannot be carried on without assistance of shore-labour, it gives employment to more than as many more, such as packers, curers, labourers, watchmen, coopers, net-makers, riggers, &c., and a vast number of other trades too numerous to mention.

So, we have 50,000 wholly and directly depending on this industry for support, and more than double that number on shore whose maintenance is derived from it, independent of tradesmen.

I said the development of the trade might be traced to the use of ice, this is manifested in the history of the trade at the ports of Hull and Grimsby.

	Tons.	£.
Hull in 1845 possessed 21 vessels of	570 value	6,425
„ 1873 „ 330 „	19,800 „	247,500
„ 1882–83 „ 417 „	29,233	„ 555,000
And 9 Steam Carriers, and 6 Ice-ships		

Grimsby, in 1845, was not used as a fishing-port, but thirteen years later—1858—a few—some four—of the Hull smack owners were induced to migrate to Grimsby, and others soon followed; but the fleets being too small in number to work the trade successfully, ice was introduced by which means each smack could fish his own voyage, iceing each haul till a sufficiency was obtained to make a payable trip, when he made sail for land; this introduced, what is now known as "single boating" and "iceing in bulk." The London or Barking fleets, as they were called, began the iceing in boxes or trunks, and at length introduced steam carriers to bring their fish from the fleets.*

Hull also adopted the iceing and single boating system, and prospered, as the 28 years will show, the increase being from 21 to 330 craft, with a like increase of tonnage.

In 1868 Grimsby had advanced to some importance, and the trade was in that year 26,621 tons fish; in 1880 this had still further increased to 46,930 tons. Thus we may trace to the application of ice—and also in the case of Grimsby, *special railway and dock accommodation*—the great and rapid development of the North Sea trawling. Hull has not advanced of late years so rapidly as Grimsby, but I attribute this to the want of ample and suitable dock accommodation, and the indifference of the railway company to our wants, and not from want of spirit and enterprise in her fishermen or smack owners.

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* They first iced the fish when it was packed in baskets called pads, half-pads, and pots, the ice being simply spread over it. The introduction of the trunk system was a great means towards the better preservation of the fish.

I give these instances as illustrations to show what can be done, and to point out in what direction we may look for further development. One word gives it, viz., *accommodation.*

As the increase in the number of smacks has gone on, so has also their size and tonnage increased, and we find the small boat of 24 tons now replaced by that of 90 tons, with steam appliances and improvements for getting their gear. As one thing leads to another, this has come about by the introduction of ice as a means of preserving the fish. Fishermen finding more fish by venturing farther away have gradually extended the fishing-grounds, almost covering the North Sea. Away across the Dogger Bank to the Horn reefs, and across the Fisher Bank, and in deeper water, up to 48 fathoms, after the haddocks and plaice, go the Hull and Grimsby fishermen in the winter months; and away down there, 240 and 260 miles from Spurn, in the N.E., scattered about, may now be found the single boats in great numbers. It is here the deep water necessitated the introduction of steam-power in getting the gear, and this new feature in the business soon begins to show itself, and is widely adopted. These vessels now frequently remain out three and even four weeks getting their voyage.

Meanwhile Messrs. Hewitts continue their system of fleeting and boxing with steam cutters, and as the fish is falling off more nearer home, some of the smacks from Hull and Grimsby and also other ports have resorted to their fleets, catching and sending to London; and then steam carriers are tried at Grimsby, then at Hull, and in 3 years a fleet of 13 steam carriers—9 from Hull and 4 from Grimsby—are found in attendance on the three fleets sailing under this system from the Humber. And this brings us to the present; indeed

"Old times have changed,
Old manners gone."

We live in an age of progression.

With this development, has the knowledge of the fishermen themselves also advanced? Yes—by extending their searches after fresh fields of enterprise comes the necessity of a better knowledge of navigation, and although the majority trust to "Blind Navigation," the lead and soil, to carry them about, and by this means do find their way about, yet there are a great number who are fairly well versed in navigation. I have been told of a case that happened about thirty years since, where a skipper could not find the silver pits, but had to return to Spurn to get bearings; what would the fisherman of to-day think of this? Is inshore trawling by steamers, and shrimp trawling in rivers and bays injurious? Yes. Without doubt great injury is done by steam trawling inshore as practised by the steam tugs in the north. It has been very recently adopted, and a very great deal of fish has been caught close inshore, in places that could not be worked with advantage to a sailing trawler, on account of the rough ground affording only a limited area of clear bottom to fish. These spots have been the haunt of the fish, and they have, undisturbed, bred and increased there; the result of it has been a falling off of late. I believe much harm has been done by destroying young fry, but much greater damage has been done by the small boats which trawl for shrimps in our bays and estuaries. The nets of these trawls are so fine, and the mesh so extremely small, that nothing escapes it, and thousands of bushels of young fry are slaughtered by these craft annually. Not only on the British coast is this mischief done, but by the Dutch also, to a serious extent, in such places as the Zuyder Zee, not only are the fry taken, but occasionally a fine turbot or two is captured full of spawn; it is not an unusual thing to see fine turbots of this class, weighing 14 or 16 lbs., landed at Grimsby from boats fishing for shrimps in the lower part of the Humber, and of course the same thing is done elsewhere; what a wealth of food is thus *wasted*—the choicest the sea produces. These fish come in to spawn at certain seasons, and if left undisturbed for a time, as is the salmon, the increase would be enormous. It is a question in my opinion of no little moment whether this class of shrimp trawling should not be restricted, and steam trawlers compelled to fish beyond a certain limit of our coasts. My own opinion, based upon the facts now pretty widely known, is that inasmuch as these are the breeding places of the fishes that abound in the deep waters, it is a proper question for the attention of our legislature. Is the shrimp or prawn of the greater value as a food? Is the supply of the sole and turbot to be diminished to the enormous extent it has been of late years, and remain unchecked, that the shrimp or prawn may have its place at our tea table?

If a close time is necessary and beneficial in respect to the salmon, and there is no way of making a close time for sea fishes, should the wholesale destruction of immature fish which is going on be allowed to pass *unnoticed*, and without any *attempt* at legislative remedy? I trust some one more able than myself will be found to take the matter up.

The sole is yearly becoming scarcer, and consequently dearer, and almost out of the reach of the poor man, and, like the salmon, may be classed as the rich man's food only. To what other cause must we attribute this diminishing of supply? It has been an old proverb, that there is as much fish in the sea as ever was caught; but I should hesitate to apply this to the sole. Soles are still caught on the same grounds as before, but in such diminished quantities that they do not pay for the venture, and our boats from the Humber seek fresh fields of enterprise, and depend on the haddock and plaice, which abound on the Dogger and Fisher Bank, for a payable cargo.

When the silver pits were first discovered, and became frequented as a fishing-ground the sole was found in the winter months in such enormous quantities, that the name "silver pits" was to the fisherman no unmeaning one—so prosperous were those who resorted thither. It was not an uncommon thing for a trawler to get there 40 to 60 pots per night, which would be a ton to one and a half of a ton. The price would be from 6*s*. to 8*s*. per pot, or say from 10*s*. to 16*s*. per trunk. I have known them sold for so low as 2*s*. 6*d*., 3*s*. 6*d*., and 4*s*. per pot. The value now is from £4 to £10 per trunk, the price having risen as the take has diminished to its present insignificance.

Again a new ground was found on the opposite coast, about the island of Heligoland and Sylt. About the year 1868 soles were found there in immense quantities; but the supply is not now anything so great. Off the Texel, and indeed up and down the entire coast, the supply of soles is diminishing. May we not inquire here also what is the cause, and receive the same reply—destruction of fry? If sole has been found in large quantities in the pits in winter, about Heligoland and the Texel in summer, do they not resort to the large estuaries to spawn in summer? And undoubtedly they do, and take to deep water in winter. If inshore trawling and shrimp trawling was restricted, I am of opinion it would be much more beneficial to the fishermen and the community. The fish would have a better chance to come to maturity, and the harvest of the sea would be better.

There is one important point I should not wish to pass unnoticed—it would require international laws; but would it not be worth while to enclose certain parts of rivers and bays, and in such places as the Zuyder Zee as breeding grounds, where the spawn could mature, and when the fry was sufficiently developed it might be allowed to escape into the sea? The question is a wide one, I admit, and could not be carried on by private enterprise; but if taken up by the nation simultaneously with other countries, it would be immensely advantageous, as it would afford means to study in these places the habits and growth of sea fishes, of which we know yet so very little.

Chance brought about one of the most astonishing results in the history of the fishing trade about the year (1844), and founded the trade at Hull in consequence. One of the Ramsgate boats in extending her searches for fish was by adverse winds blown further north than it was the intention of her crew, but determined to make a try they shot their trawl in what is now so well known as the silver pits, and their plucky venture and labour was rewarded by a "miraculous draft of fishes," which were nearly all soles. Very soon this became noised abroad, and other boats followed who were equally well rewarded with good results. Hull was found a convenient port of resort, and gradually became the home of the fishermen's families for the winter season from September till April, when like the swallow they took their flight southward again, till the season came round. The number of vessels yearly increased, and were added to by Brixham sending her hardy sons in numbers to swell the ranks. Then a migration from the south and west takes place, and many owners and men with their families took up their permanent abode in the good old town of Hull. Hull flourished, and the smacks were steadily on the increase both in numbers and size, and doubtless would have advanced by greater strides had more ample accommodation been afforded by the dock and railway authorities.

Sir Edward Watkin, an able and far-seeing director and chairman of the M. S. & L. Railway, invited a number of smack owners to Grimsby with promises of help in advancing their interests ; a number in response went there, and thus a second fishing port was established on the Humber, and which now outrivals Hull. There is now a fleet of trawlers sailing from the Humber of about 800, this is a surprising increase in 37 years, from 21 small vessels to 800 of the finest and largest of our trawlers in the North Sea.

Some years ago it was affirmed that trawling did great mischief by destroying the spawn, but that foolish notion was exploded by the inquiry that was then made in consequence, and which brought out much valuable information. It was then asserted in defence of trawling, "that like the plough the heads and trawl worked the bottom of the sea, doing good instead of harm." This statement I think has been borne out by facts since, one of which is worth mentioning: A few years ago (ten or twelve perhaps) our trawlers worked one part of the Dogger, finding a class of plaice in great quantity which were so ill-fed and of such a peculiarly muddy colour that they received from the fishermen the sobriquet of "Elephants' Lugs," so closely did they resemble them. These fish were sold at from 4*d.* to 5*d.* per stone of 14lbs., and found their way across the sea to the Dutch in a pickled state ; in the course of time this has changed, and no fish of this description is found, but in its place fine well-fed fish of different colour, clearly, I think, showing that the trawl by turning up the bottom has changed its character and also the food of the fishes feeding there. The fish now caught will make 3*s.* and more per stone.

The principal kinds of fish caught in the North Sea are the sole, the turbot, brill, plaice, haddock, cod, ling, hake, lemon sole, whiting, halibut, cat-fish, skate, ray, and other sorts. At one time, when our vessels used to fish about the Botney, about September and October, they found dog-fish in immense numbers—as many as a ton at a haul would be got, but these have diminished very considerably. As they were full of herring when taken, it plainly indicated what work they had been on, so the herring fishermen have something to thank trawlers for if they have the candour to admit it.

Of the kind of fish which our trawlers now depend on for profit, the haddock and plaice are mostly sought after, as they are found in greater quantities—if there is a failure in the herring season, haddocks are of more value for curing purposes, as they are bought instead of the bloater.

Trawl fishing by day is not so profitable as at night. A day haul will not yield so much of the round fish, haddock, cod, ling, &c. It may be assumed that the haddocks and cod rise from the ground by day and sink again at night, when they are caught in greater abundance. S. and S. W. winds are the best for fishing, with a nice moderate breeze, as the trawl is towed over the ground at a moderate rate and is kept open. N. and N. E. winds are unfavourable, as the ground swell caused thereby disturbs the fish.

Is trawl fish migratory?

Doubtless, as fishermen know from experience, it is useless trying certain grounds in some months; but at regular periods fish will be found there, and they are pretty regular in the time of their return or taking off as is the swallow. Our fishermen may be said to follow the fish, going from one ground to another as the seasons come round.

The fishing grounds most frequented by vessels from the Humber are the shoal of the Dogger, the S.W. and N.W. spit of the Dogger, Clay Deeps, the N.E. part of the Dogger called the "Cemetery" from the rough, stony nature of the bottom compared to grave-stones, the Fisher Bank, and beyond the Fisher Bank, Jutland Reefs, the Long Forties, the Horn Reefs, the Sylt, the Amram Bank, Heligoland, off the entrance of the Weser and Elbe, Nordney, Borkum, Terchelling, Texel, &c., besides other grounds south of the Humber, such as the Wells Bank, &c. Messrs. Hewett (the Barking fleet) now rarely go fishing below Heligoland, but keep about Borkum and Nordney in the summer, and the S.E. part of the Dogger and Botney in the winter.

Plaice are to be found only in the spring, and fall on the shoal of the Dogger, and in the summer on the Horn Reef and Borkum. In winter below the Dogger and off the Flambro' Head.

Haddocks are found in abundance on the S. W. spit of the Dogger, about October; in September and October, they work along the pit edge of the Dogger, and, when taken, they are found to have plenty of herring and spawn in them.

Soles are caught on hard sandy ground, in warm weather taking to deep water, such as the pits where the bottom is muddy and soft in winter, for warmth.

DESCRIPTION OF TRAWL.

The trawl varies in size as also the mesh, and requires great art in fixing. Some trawls are 78 feet long, with a beam of 48 and 50 feet, with trawl heads of 4 cwt., and these, in deep water, require 20 fathoms of bridles, and 150 to 200 fathoms of 7 to 7½ inch trawl-warp. The size mesh of the trawl is much smaller as we go south of Yarmouth. About Hull the mesh is about 3½ inches square down to 1½ inch.

My friend, Mr. Sims, will hold up a model of a trawl net, and I will endeavour to describe it. I should say that these trawls are made on shore, principally by females, and are tarred with coal tar. They are made in four parts, and are afterwards put together by the men on board the ship. The *square* of the trawl is 48 feet long. The *batings* is the part attached to the *square*, running down to the end, and diminishing in size as it goes down to make the funnel shape. Then comes underneath the *belly*, which is made of a considerably heavier twine, in order to give it strength. The *wings* run at each side and connect the *belly* and the top ; they are carried on to the head, and to this is attached the ground rope. This is generally 16 fathoms in length, but sometimes it is shorter. The regulation of the trawl is a very peculiar matter, and each fisherman has his own fancy as to the fixing of the trawl, in his own particular way, in order to make more or less *bosom* to the trawl. The trawl is first attached to the balch—a small line about the thickness of the finger—and then the balch is attached to the ground rope by pieces of twine about three feet long, called the settans. Then comes the head-line, running along the cross-beam to where it is attached by grummets, there being a double mesh to the head of the square to give it strength, and through which the head line is rove and then attached to the beam and heads. Now comes the cod line at the bottom. Underneath we have the false bellies to prevent the bottom of the net, with the weight in it, from chafing out and letting the fish escape. The cod line is the secret of the whole, because when the net is hoisted in this hangs down over the deck, and when loosed opens the net like a lady's bag, and the fish fall out. It is tied up when the trawling is going on. Then there are also what are called pockets. If it is loitering weather the fish will try to escape and go up into these pockets, just here is placed a kind of trap-door called a *flapper*, which hangs down, so that when the fish has passed in it cannot go beyond. It is a very ingeniously contrived trap for catching fish. If the vessel is fishing in 20-fathom water, it requires, according to the wind—whether a loitering wind or a fresh wind—more or less length of warp. The fishermen must be mathematicians in their own way. The ground is the base of a triangle and the smack the apex of it, and you will see that they must necessarily have upon the average a warp three times as long as the depth of water. Thus in 20 fathoms the vessel would require 60 fathoms of warp out, independent of the bridles. If the wind is very strong this length can be increased; if it is loitering it should be diminished. So that fishing is an art which requires continual attention to trawl warp and to the sails of the vessel, to moderate or accelerate her speed to such a degree that the trawl shall always be doing its work evenly and smoothly over the bottom of the sea, not in a jerky manner, which would lift it; if this occurs the ground rope is lifted off the ground, and the consequence is that the fish, instead of going into the net, escape underneath it. The object of having the trawl heads high, as we have them in

Hull, and giving what we call a good back to the beam, is to lift up the *square,* in order to catch the haddock, as they are always found to swim further from the ground than other kinds of fish. Therefore the higher the heads are the more haddock are caught. Again, with the ground rope, if the men want to catch soles, some of them resort to chain ground ropes. The smaller and heavier the ground rope the more it attaches itself to the bottom, and the more soles are caught in consequence. The habit of the sole is to keep close to the ground ; and sometimes, I have heard it said by fishermen, the soles are supposed to be buried underneath the sand, and require a great deal of disturbing to get them into the nets. I do not know whether there is anything I have left out ; if so, perhaps Mr. Sims will tell us.

Mr. SIMS : In fishing hard ground for soles we should shorten the ground rope, and not drag the trawl quite so fast ; just go with the tide. But if we are fishing for hake or haddock, then we say, "Give her sheet ;" that is, force it all you can, so that you do not lift it off the ground.

Mr. ANSELL : The cost of a first-rate trawler, such as the model now exhibited, with all appliances, and nearly 1,000 yards of canvas is about £1,600 ; we have many such in Hull, and hope to have many more. The proceeds of the catch on the single boating system are dealt with in this way : A trawler generally makes three voyages, lasting six or eight weeks, and when settling time comes, the working expenses, such as salesmen's commission, the expense of landing the fish, and other little items are taken out first. Then comes the sharing ; the Captain gets a share of 1⅜ ; the mate 1⅛, making 2½ shares out of 8, leaving the remainder for the owner, out of which he has to supply the smack and all fishing gear and nets replacing when worn out or lost, which is frequent, also the food for the three remaining hands, which averages about 10*s.* a week, and to pay them their wages. The third hand, as we term him, who comes next to the mate, receives £1 a week; the deck chap 16*s.*, and the cook 10*s.* That is about the average wage from Hull, varying 1*s.* more or less according to the emergencies to which the owner is put when he equips his vessel for sea. The working expenses of a trawler are about £400 per annum, independent of wages. The fishermen, I may say, make a very fair living out of their ventures at Hull and round the coast. Messrs. Hewitt sail their vessels on a somewhat different system, but still on a kind of partnership—capital and labour combined, which I hold is the best method of working that can be devised. The more work the men do, and the more successful they are, the more money they get. Messrs. Hewitt's system is slightly different, but it comes to much the same. I prefer the Hull system myself and so do our fishermen. As an owner I do not, because I do not get quite so much as Messrs. Hewitt do.

On the single boating system a smack can remain away three or four weeks, iceing and catching his voyage. A night haul is made by shooting the net about 8 P.M., trawling till three or four, about eight hours. A day haul is about five hours; but the length is necessarily regulated by the nature of the bottom where they are fishing; under the Boxing system the fish are sent to market every day by steam carriers, and the vessels fish in fleets together, and their movements are regulated under the control of an experienced fisherman who is the appointed Admiral; these movements and also the fishing are directed by means of flag signals by day and by flares and rockets at night. Each fleet has its own particular code, one of which is the following :—

Admiral's Signals by Day.

For sailing	Flag at foremast head.
For trawling	„ hauled down.
Not to board *	„ at mizenmast head.
Sailing before boarding	„ both mast heads.
Cutter wanted	„ half mast.

Admiral's Signals by Night.

For sailing	White rocket at intervals.
For tacking	Flare on quarter and a white rocket.
For trawling on port tack	Three flares and a red rocket.
For trawling on starboard tack	„ „ green rocket.
For hawling (getting the trawl)	Two flares and two white rockets at one time.
For laying to	One flare at mast head and one on the quarter with a white rocket.

In strong winds the fleet sometimes get scattered, and to facilitate their gathering again without loss of time, different places of rendezvous are arranged according to the season of the year, thus :—

From February 1st to March 1st	Tail end of the Dogger.
From March 1st to August 1st	Off the Horn Reef Lightboat.
From August 1st to October 1st	Clay Deeps.
From October 1st to February 1st	The Silver Pits.

These are well-known places to all fishermen.

The steam cutter will bring to land from 1000 to 3000 boxes or trunks of fish containing 5 or 6 stones weight each, doing the distance in from 30 to 36 hours from fleet to port. After discharging cargo, she commences to load again with ice and empty trunks for the fleet at sea, taking out also clean clothing and many a loving epistle from dear ones at home, also stores of food and net, sails, rope, boats, &c., &c. Thus a continual communication is kept up with the land, and information supplied to those at sea, of all that is taking place on shore—the state of the markets and so on.

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* Boarding means ferrying the fish from catcher to cutter.

Amongst these fleets may be seen the abominable "Cooper" or floating grogshop doing its deadly work, but thanks to the Thames Mission, a powerful influence is now brought to bear against them by mission smacks on board which the Bethel flag is hoisted and divine service held regularly on the Sabbath with excellent results.

Considerable feeling has been evinced by the fishermen at Hull and Grimsby against the Boxing system in winter, but as the system becomes more established doubtless this feeling will wear away.

In summing up the advantages or otherwise of the two systems of fishing as practised out of Hull and Grimsby, the recent Board of Trade inquiry at Hull says, "We are of opinion that the 'single boating' system, whilst ensuring to the men less hardship and possibly conducing to instruct them in a more perfect knowledge of their business, is also productive of a great waste of fish. The fleeting system, on the contrary, is calculated to secure a more regular and continuous supply in a fresher state.

This system is pretty generally adopted in the summer months—from April to October—by the Hull and Grimsby boats. But there are some who still keep to the old bulk system of fleeting; these will join in companies of 20 to 30 boats, and share the result of the common catch at the end of the voyage—the duration of the voyage on the Boxing and the Bulking system is about 8 weeks. The difference is in the mode of conveying the fish to land and the results. In the Boxing system the fish is packed in boxes, and ferried each morning to the steam cutter in attendance, is then put below and covered in ice, and soon the cutter is on her passage to Hull or London. In the Bulking fleet, as it is termed, the fish is ferried to the sailing cutter and then placed below in compartments or pounds, each kind by itself, and placed in alternate layers of ice and fish without boxes. On arrival at market the fish is picked up by hand and filled in kits or turns, and sold in Hull, by weight, and Billingsgate, London, by package.

When October comes a considerable number of boats leave the Box fleet, and the Bulk fleets break up partnership and then resort to the single boating system, by which each boat is on his own venture and goes to what fishing ground he fancies most. By taking in a stock of ice of from 5 to 8 tons, a vessel will continue on the fishing ground until he has secured sufficient to come with as a paying voyage. They will sometimes remain away three or even four weeks, going so far as 240 miles or more from Spurn to the Fisher Bank and beyond, and fishing in 40 to 48 fathoms of water. These boats are mostly supplied with steam capstans, and from 150 to 200 fathoms 7¼ inch trawl warp is required. The application of ice and steam to trawling has brought about wonderful changes; by its aid the vessels have by degrees extended their searches after the finny tribe. All over the North Sea, and there is not a patch of ground in it that is not as well known to the experienced fisherman as the land on which we dwell, and in confidence he treads the deck as

> "O'er the blue sea
> His gallant barque bounds merrily,"

bringing home to thousands of toiling creatures cheap and wholesome food.

EVIL EFFECTS OF MEDDLESOME LEGISLATION.

By the alteration in the Merchant Shipping Act in 1880, by which the apprentice system was virtually abolished, a serious blow was struck at the very root of the trawling industry, and its injurious effects were severely felt by all smack owners and fishermen engaged in the deep sea trawling. It fell here perhaps more heavily than in any other branch of the mercantile marine. Had the Act been prospective instead of retrospective, the effect would have been milder, but by taking away the only means of correction, and substituting a shadow, the master and apprentice soon felt the difference in relationship, and the apprentice became more unruly, and, by a series of acts of insubordination, tired the master out and the apprentice gained his liberty. The effect has been to rob the master of his apprentice's service, entailing a loss on the trade in Hull and Grimsby alone at a modest sum—£10,000. It is needless to say that few or no boys are bound now, whereas in Hull and Grimsby, when the Act came into force, there must have been no fewer than 2,000 apprentices. Their place is now supplied by casuals, drawn from every source, and in consequence unfitted for the work they are called upon to do; the evil results of this will be felt more by-and-by than at the present. Trawling is an art requiring skill and knowledge beyond ordinary seamanship, and which can only be acquired by training and practice. They must come to it young, pass through the different grades from cook to skipper, be taught to make and mend a net, to fix and tow a trawl, to know the proper grounds and times to go there, become acquainted with the habits of the fish they catch; and to be inured to every danger, knowing no fear, of robust health, and sound intelligence. This training can only be received young, and it is gradually learned whilst apprenticed. The sooner the Act is altered the better it will be, for no better nursery for the navy can there be than the trawl fishery, as the history of the days of Nelson and Drake will tell.

Time will not allow me to go into the working of this business any further than I have done in a light manner, skimming as it were but a little from the surface. His Royal Highness the Duke of Edinburgh has placed valuable facts before the world, and it is only for me in the main to corroborate the statements made by that illustrious sailor.

If we review the past and look at the forward prospect, we cannot doubt, but that, with the recognition it is now receiving and with judicious help, there is a *great future* for trawling. The gradual tendency is towards steam, by the help of which longer distances can be gone. So with good harbour or dock accommodation and cheap railway rates, combined with the application of steam and ice, there is nothing to prevent the extension of the trade beyond its present proportions, by as great advance in the next quarter of a century as it has made in the past. May we hope for such success in abundance, that these "toilers of the sea," by bringing in its harvest, may enrich themselves by doing good to others.

DISCUSSION.

The CHAIRMAN, n inviting discussion on the Paper, said he should like to call attention to one point, and that was as to the size of the mesh. Perhaps Mr. Sims, as a practical trawler, would say something.

Mr. SIMS said that after the very excellent way in which Mr. Ansell had handled the subject it was unnecessary for him to go further into it, except just to describe the mode of trawling since he knew it. He did not see any difference in the shape of the trawl now from what it was 50 years since, and the only difference was that it was extended in size. He should be quite willing to go with the Chairman in the line of having the mesh larger, and thought it would be a great benefit to the trade at large. As for destroying immature fish, he thought if there were not some means taken to prevent destroying them in the bays and estuaries, in the course of a very few years the sole would be a thing of the past. He did not say they were going to exhaust the sea, because he thought there were as many soles caught now as there were 50 years since, but they were about one-fiftieth part of the weight. If you went to Yarmouth beach you could see the men picking out small immature fish—soles half as long as his finger—he was sorry to say he had done it himself—and turbot so to speak not larger than your thumb-nail. It was no use throwing them overboard, because after they once got into the net they were dead. This summer he had known that the smacks on the Jutland Coast had been taking shovels, and shovelling overboard by the ton small immature plaice, not larger than the thumb-nail and many not larger than the palm of one's hand. He believed that scientific men had done wonders in regard to the salmon fishery; they put a hedge round it, and put a guard upon it, and if it had not been so what would have been the consequence by this time? Unless there had been a close time for the salmon fishery, and all inland fisheries, he believed they would have been exhausted before now, or very nearly so. But when the inquiry was held there were men of science examined and fishermen; but fishermen were only anglers—fresh-water fishermen—they never called in the aid of any deep-sea fishermen at all. Their opinion was never asked on the matter. The salmon fisheries were improved, and would be more improved until salmon would be sold alongside of plaice, and in fact plaice would have the advantage, and make more money than salmon, because it would be scarcer, whilst the sole would be a thing of the past unless something was done. He could not say what should be done, but something must be done if they were to have a sole at all in this country. In conclusion he would say that he believed the Exhibition was got up for the benefit of the fisheries, and he saw that the numbers of those who had been were close upon a million. There would, therefore, be a great return for the outlay occurred, and the question was what should be done with the money? He would say, let the trade have the benefit, and the way he would suggest would be by laying the foundation for an Orphan Home for fishermen. H.R.H. the Duke of Edinburgh said something should be done for them in the way of insurance, and he thought they might start in that direction. If that were done, he, as a fisherman, would add one brick to the building, and if the plan were adopted he would give 500 guineas to start it.

The MARQUIS OF HAMILTON then proposed a vote of thanks to Mr. Ansell for his very able Paper. It was evident to everybody that it was the result of a practical mind, and of long attention to the subject, with which the writer was very familiar. He had attended many of those Conferences, but he might safely say that both in the subject matter of this Paper, and in the way in which it had been handled, it was second to none. Some of the matters touched upon might, no doubt, be open to discussion, but without discussion they could arrive at no practical result. The noble Chairman was a practical trawler himself, and he had no doubt he would, as an amateur, be able to give information, which would coincide very much with what had been said by Mr. Ansell. Few people who lived on shore and consumed fish from the sea, were aware of the great dangers undergone by fishermen in obtaining this fish, and he thought the trawlers had to encounter no less danger than any others. It must be the desire of all those who were interested in fishermen or fisheries to promote as far as possible the welfare of that class—not only to protect them in their vocation, but also to enable them to increase the supply of that food, by means of which they earned their livelihood. Mr. Ansell had touched upon two subjects referring to this matter—the question of legislation, and also the importance of lower railway fares for the carriage of fish. With regard to legislation there had been able remarks made, not only by Mr. Ansell, but also by Mr. Sims, with regard to the matter of protection of immature fish, and he was one of those who could not think that the supply of fish in the sea would for ever be inexhaustible, and therefore it appeared to him that legislation in that direction could not fail to be hereafter of practical value. Immature children, both girls and boys, were protected by law, and why should not the immature species of fish, which afforded one of the greatest sources of food, also be protected ? Again, with regard to the subject of railway rates, he trusted that the result of the Exhibition and of the Conferences and Papers which had been read might be to draw the serious attention of Railway Directors to the subject of revising the charges for carrying fish from the seaports to the great centres of civilisation. If any practical results in this direction were realised, he was sure those who had promoted the Exhibition would have great cause to rejoice. He was glad to hear the few remarks made by Mr. Sims, who was evidently one of those sanguine natures who thought the Exhibition would be a financial success, and he sincerely hoped such would be the case.

Mr. BRADY seconded the vote of thanks, which was carried unanimously.

Professor HUXLEY then proposed a cordial vote of thanks to Earl Ducie for his conduct of the business of the meeting. As the Marquis of Hamilton had observed, Earl Ducie was himself an experienced and practical trawler, and he quite coincided with what he said about the value of discussions upon the Paper. It was a somewhat unusual circumstance that there should be in the chair a nobleman who could practically manage the business of a trawler as well as any of those practical gentlemen who had been before them.

His Excellency Admiral POLO DE BERNABÉ seconded the motion, which was carried unanimously.

The CHAIRMAN, in responding, said he felt much pleasure in having heard the Paper in which Mr. Ansell had given such a very exhaustive account of the growth of the trawling-trade, of the increase in the size of the ships, and of the greater spirit of venture on the part of the fishermen themselves in traversing wider spaces of the ocean and deeper waters. No one had yet traced the origin of trawling. Mr. Holdsworth, in his valuable work on sea-fishing, said it was probably not a century old. But curiously enough Mr. Froude in his History of England, when describing the running fight with the Armada, tells us that when further munitions of war were wanted the "fastest trawler" in Brixham came out with further supplies ; here he was probably mistaken—the vessel being, no doubt, no more than a fishing boat. He was very glad to hear from Mr. Ansell that he believed there was a great future for trawling. They were apt to hear rather doleful accounts of the prospects of fishing ; that fish were dearer and scarcer; and yet it was a remarkable fact that the number of men increased. The number of vessels, and their size also, was increasing from year to year. There was very often an outcry for legislation, but no one seemed able to indicate what particular direction the legislation should take. The only practical suggestion to-day seemed to be the suppression of the shrimp trawler, and he had noticed in the different Conferences that one set of fishermen generally wanted to suppress another. He had no doubt that shrimp trawlers did some mischief, but whether they could be stopped, whether the English shrimp was a less worthy animal than the sole and turbot, and the interest of shrimp trawlers less than those of the great mass of men who went sea fishing—he would not attempt to discuss. Professor Huxley alluded to his being a practical trawler; but it was only in an amateur way, as a yachtsman, that he had done anything in that way, a very different thing to earning one's living by trawling. His suggestion that something might be said about the size of the mesh, had arisen from his own experience. Not having to get his bread by fishing, he was glad to have a large mesh in order that he might allow the small fish, and what sailors called muck, to escape, and he found very great advantages from this large mesh. First of all, such a trawl occupied less space, cost less to make, was more easily dried, more easily drawn through the water, and more easily hauled up, and on the whole secured a better class of fish; of course the smaller fish did go through, and he was glad of it, because he knew that in future years they would become larger ones. That was his experience, which was only with what was called an otter trawl, only available in shallow water, and never be spoken of in the same breath with a beam trawl. It was a very easy and very cleanly instrument, but only fit for amateurs.

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